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Jet Awakening

TO an American it must seem ironical that though no other nation is in such an economically sound position, it is principally for reasons of expense that jet transports are still on United States drawing-boards while Britain and Canada already have promising and well-advanced designs in the air. Only comparatively recently has America become jet-transport-conscious, although the turbojet for military aircraft has held nation-wide interest since it became known that the first power unit of this kind had been shipped from England to America for examination. Not unnaturally, the American industry has hitherto concentrated its attention upon military aircraft, for which plenty of contracts have been forthcoming, and undoubtedly the success of the Comet and of the Jetliner in Canada has given a profound jolt to that justifiably complacent section of the American industry which has of recent years provided equipment for the majority of the world's airlines.

The overall shock has been the more severe because, preoccupied as they are with their own diverse affairs, Americans are not on the whole as well informed about progress in other countries as are those countries about American developments and ideas. It is widely believed in the United States (and in some quarters the belief is carefully fostered) that the British aircraft industry is nationalized and fully subsidized by the Government. "We could have built the Comet if the U.S. Government had put up the money," they say. Yet of all large post-war civil projects in this country, the Comet owes most to private enterprise and capital—though not, perhaps, to the extent of $25,000,000 to $30,000,000, the figure quoted by Capt. Eddie Rickenbacker for the development of a comparable aircraft.

For our own part, it would be foolish to under-estimate America's capacity, and we agree with Mr. Beall of Boeing when he says that they do not feel the overall picture of American jet-transport development to be as gloomy as stories would have them believe. ". . . We can pick up where they have left off and bring out an improved aeroplane," he says. Mr. Beall's company, makers of the Stratocruiser, have as many as three civil jet designs under consideration, and have also a great deal of supporting experience with the six-jet B-47 bomber. Incidentally, the thin, very flexible, swept wings of this striking design may provide a partial solution to the gust and turbulence problem with high-speed transports, for test pilots report a remarkable damping-out of bumps, the fuselage riding as if supported on a pair of vast leaf-springs. With the Stratocruiser and B-47 in mind, it will be interesting to hear what Boeings consider a practical wing-loading for a jet transport.

Many other Americans have voiced an opinion on jet airliners. An ostrich outlook is attributed to Senator Johnson, who is reported as saying: "When trans-ocean jets are practical, you can bet that U.S. manufacturers will be ready to build them." An influential aviation columnist, Max Cook, quoting 1956 as the probable date for American jet transports to commence operation, is reported to have said that the problem does not so much concern engines, the United States being ahead in this field. It seems such an unlikely statement that he has probably been misquoted—a not unusual occurrence. Although American manufacturers can almost certainly draw upon sufficient experience to enable them rapidly to produce high-speed transports ahead of any in being to-day, the same cannot be said of the power units. There is no known American turbojet which satisfies the requirements for civil operation, or which has achieved the standard of performance, reliability or life between overhauls of those in use in British gas-turbine transports.

There is real and justifiable concern in America lest the country lose not only world but domestic markets as well. If the absence of financial support is the main problem, there is little doubt that some way of overcoming the deficiency will be found. Mr. Beall will have the support of all his country's industry when he states: "We do believe that this country must immediately start planning for jet transports if we are to maintain our role in aviation progress."

It is gratifying in Britain not only to have such confirmation of the wisdom of decisions taken in the aircraft industry three to four years ago, but also to find that for once, as a nation, we have planned and prepared in advance.

SHIPS and FLYING-SHIPS

Ocean Liner and Marine-Aircraft Development Compared : A Study in Progress

By Lt. Cdr. L. G. GRIFFITHS, R.N. (Ret.)

IT is generally acknowledge that the behaviour of a body in air is in most respects similar tc that of one in water. The relation of speed to horse-power is governed by the same basic laws, while in each case waves are created in much the same way.

One might, therefore, be justified in outlining an analogy of marine transport to air transport.

About 25-30,000 years ago, it is believed, Neolithic man paddled himself about on logs of wood or better still, used an inflated skin as a primitive means of river and sea transport, trusting to God and the unpredictable weather condition to arrive eventually at his destination.

A rather far-fetched analogy would appear to bring this parallel to the balloon as we know it, although some 25,000 years later, according to legend, Daedalus manufactured a flying machine of sorts, probably a primitive glider, which came to an ignominous end by collapse in the air and final destruction in the sea.

THOUGH this comparative study of two spheres of transport is an academic one, the author's conclusions—particularly those emphasized in the development curves—will be of considerable interest to students of what might be called long-term design. For a variety of reasons he has confined his marine-aircraft examples to British types : had he included certain notable foreign designs, such as the Dornier DoX, the Martin Mars and the Hughes Hercules, the picture might have been somewhat changed, though his principal argument—the consistency of progress that is apparent in the two spheres—would remain substantially unaltered

This point is made to demonstrate that, compared with aircraft, the development of marine craft has been at a great advantage in time; even so, it has not been until within the last four hundred years that we arrived at the first development of well-rigged, ocean-going sailing ships, superseding the galley with slaves sweating at the primitive oar against the forces of nature which confined their activities to coastal waters.

With the dawn of the mechanical age, steam began to take the place of sail about 1840; in 1851 the screw propeller replaced the paddle wheel, and wooden ships became obsolete with the advent of iron construction. In 1881 iron was superseded by steel, while during this long "experimental" period the trend was a gradual increase in range, speed and displacement (see Table I).

It may be said that, during this period, the most striking enterprise was the building of the *Great Eastern*, of 18,915 tons, in 1858—a mammoth ship of her day, which had a fairly successful career in trans-oceanic cable laying; although this craft was not of the Cunard White Star fleet detailed in the table, outstanding interest attaches to her and demands that she be mentioned. Her success, however, was not sufficiently great to justify a continuance of similar construction on a grander scale.

Contrasted with this, the corresponding period of experimental development of aircraft commences with gliders and landplanes preceding the first seaplane built by Short's in 1912, No. 41, of wooden construction. Table II shows a plot of all-up weight, speed and rated h.p. of a number of the principal marine aircraft constructed by Short Bros., against dates and names.

The Stellite, of 1924, with the first all-metal stressed-skin hull, may aptly be compared with the first iron ship. Gradual progress was made, range, speed and all-up weight increasing until 1932, when the largest flying boat of her day, the Sarafand, made her debut. This revolutionary advance to an all-up weight of 70,000 lb. and a speed of 150 m.p.h. with six engines giving a total of 4,920 h.p., may justifiably be compared with the appearance of the *Great Eastern* in 1858.

Of the periods up to 1858 and 1932 in sea and air transport respectively, we may say that both maritime and aircraft design and construction were successfully passing through their experimental and teething stages, preparing the way for greater things to come.

In 1904 the steam turbine had progressed beyond the experimental stage and was fitted in large ships. The *Carmania* was the first of the Cunard White Star ships to be so driven, while her twin sister, the *Caronia*, was fitted with reciprocating engines. Since that time, the steam turbine has become the standard marine engine, resulting in a very noticeable increase in the gradient of the shaft horse-power curve as compared with that of the preceding indicated horse-power figures.

Analogous to the steam turbine of 1904, gas turbines and jet propulsion of aircraft may be said to have begun to come into their own in 1944, though it was 1947 before the first gas-turbine flying-boat, the Saro S.R./A1, took the air. These forms of propulsion are undoubtedly the drives of the future for aircraft and their bounds are no more

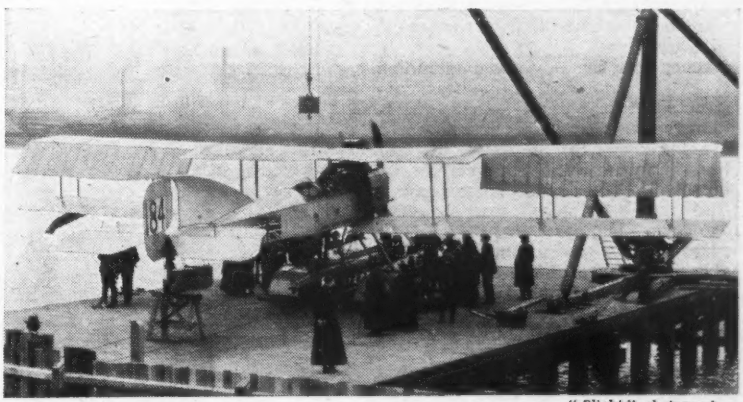
TABLE I: FAMOUS CUNARDERS SINCE 1840

Ship	Date	Tonnage	Speed	No. of Passengers	Type of Engines	No. of Engines	Horse-Power of Engines	Remarks
Britannia	1840	1,154	8.5	115 cabin	Common side lever	One	740 i.h.p.	First Cunarder; wooden paddle-steamer.
British Queen	1851	772	—	—	Compound	One	430 i.h.p.	First iron screw-steamer.
Persia	1856	3,300	12.9	250 cabin	Common side-lever	One	4,570 i.h.p.	First iron paddle-steamer.
Scotia	1862	3,871	13.00	275 cabin	Common side-lever	One	4,200 i.h.p.	Iron paddle wheel (largest in her day).
Russia	1867	2,960	14.00	430 cabin	Compound	One	2,800 i.h.p.	Single screw; noted for great comfort.
Servia	1881	7,392	16.5	480 cabin 750 steerage	Compound	One	11,000 i.h.p.	First steel Cunarder, single screw.
Umbria, Etruria	1885	7,718 each	20.25	1,000 each	Compound inverted	One per ship	14,500 i.h.p.	Record-breakers in their day.
Campania, Lucania	1893	12,950 each	22.00	1,225 each ship	Expansion type	Two each	26,000 i.h.p.	Largest twin-screw liners in their day.
Ivernia, Saxonia	1900	10,900 each	16½	1,370 each ship	Quad.-expansion	Two each	10,400 i.h.p.	Popular as passenger and freight carriers.
Caronia, Carmania	1904	20,000 each	18.00	2,650 each ship	Recip. (Caronia) Turbine (Carmania)	Two Three	21,000 s.h.p.	Caronia was twin-screw. Carmania was triple-screw.
Lusitania, Mauretania ...	1907	32,500 each	26.00	1,755 each ship	Direct drive turbines	Four each	68,000 s.h.p.	Blue Riband holders. Quad. screws, four turbines.
Aquitania	1914	45,650	24½	2,690	Parsons turbines	Four	56,000 s.h.p.	Mammoth ship in her day. Quad. screws.
Scythia, Samaria (Laconia class)	1920	20,000 each	16.00	1,500 each	Brown-Curtis turbines	Two each	12,500 s.h.p.	Popular intermediate liners for cruising. Twin screw.
Queen Mary	1936	81,235	29.00	2,000	Parsons turbines	Four each	158,000 s.h.p.	Quad. screws, turbines.
Queen Elizabeth	1940	84,000	—	2,200	Parsons turbines	Four each	158,000 s.h.p.	Quad. screws, turbines.

TABLE II: MARINE-AIRCRAFT DEVELOPMENT SINCE 1912: A "SHORT" HISTORY

Date	Name	Type	Engine	Rated h.p.	Wing Span (ft)	a.u.w. (lb)	Max speed (m.p.h.)	Range (miles)
1912	No. 41	Tractor Biplane Seaplane	Gnome	100 or 160	50		—	—
1914	—	Twin float seaplane	Canton Unne	200	54½	3,700	—	—
1915	No. 184	Twin-float seaplane	Sunbeam or Rolls-Royce	225 or 250	63½	5,100	75	—
1916	—	Twin-float seaplane	Sunbeam Cossack	320	75	6,900	81	—
1917	N/2B	Twin-float seaplane	Sunbeam Maori	275	55	4,800	92	—
1918	Shirl	Torpedo landplane	Rolls-Royce Eagle	375	52	6,000	93	—
1920	Shrimp	Twin-float sports seaplane	Beardmore or Puma	160 or 240	44	3,100	83	270
1921	Cromarty	Biplane flying-boat	2 Rolls-Royce Condors	640 each	113½	18,500	96	990
1924	*Stellite	Light monoplane flying-boat	2 Bristol Cherubs	33 each	36	1,060	—	—
1926	Singapore I	Biplane flying-boat	2 Rolls-Royce Condors	650 each	93	20,000	128	900
1928	Calcutta	Biplane flying-boat (civil)	3 Bristol Jupiter XIF	540 each	93	22,500	123	650
1929	Mussel II	Light monoplane amphibian	Blackburn Cirrus III	95	38	1,640	102	—
1930	Calcutta	Biplane flying-boat (military version for French Government)	—	—	—	—	—	—
1930	Singapore II	Biplane flying-boat	4 Rolls Kestrels	525 each	90	31,500	140	1,000
1930	Valetta	High-wing seaplane (civil)	3 Bristol Jupiter XIF	540 each	107	23,500	136	630
1931	Kent class	Biplane flying-boat (civil)	4 Bristol Jupiter XFBM	555 each	113	32,000	137	450
1932	Sarafand	Biplane flying-boat	6 Rolls-Royce Buzzards	820 each	120	70,000	150	1,450
1934	Knuckleduster	Gull-wing monoplane flying-boat	2 Rolls-Royce Goshawks	775 each	90	18,500	150	850
1936	"C" class	Flying boat (civil)	4 Bristol Pegasus XC	740 each	114	40,500	200	810
1937	Sunderland	Long-range flying-boat	4 Peagsus XVIII	815 each	113	58,000	210	3,000
1938	"C" class mod	Civil transport flying-boat	4 Perseus XII C	700 each	114	53,000	—	3,400†
1939	"G" class	Civil transport flying-boat	4 Hercules IV	1,050 each	134½	74,500	214	3,200
1943	Sunderland	Civil transport version of R.A.F. Sunderland	4 Pegasus XVIII	815 each	—	55,000	As Sunderland	—
1944	Shetland	Civil transport flying-boat	4 Centaurus VII	2,150 each	150	130,000	267	4,230
1946	Solent	Civil transport flying-boat	—	2,300 each	113	78,600	275 (est.)	—
1951 (est.)	‡Saro Princess	Civil transport flying-boat	10 Bristol Proteus turboprops	3 500 each	219½	315,000 (est.)	over 380	5,500 (est.)

* First all-metal stressed-shin hull. † Refuelled in the air.
‡ Designed and built by Saunders-Roe, Ltd., but included in this table for purposes of main argument.



One of the earliest Short seaplanes mentioned by the author—No. 184 (more familiarly known as the "Short 225") of 1915. The ailerons, incidentally, were of the "unbalanced" type.

"Flight" photograph.

limited than that of the steam turbine in ocean-going vessels.

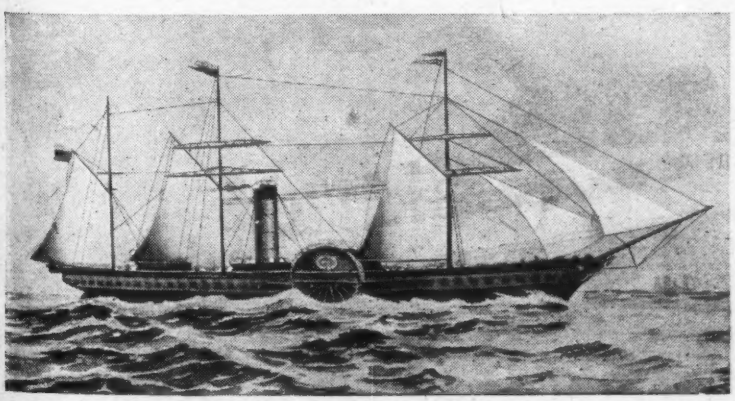
Digressing, jet propulsion has been experimented upon at sea. In the early part of the 20th century, the *Waterwitch*, a naval gunboat, was fitted out purely experimentally with propulsive power obtained by taking in water near the bows and ejecting it at the stern by large pumps. The space taken by this form of drive, however, precluded it from economical development. Much more recently, in 1947, the Admiralty revealed the existence of M.G.B. 2009, a gunboat powered by a gas turbine driving a conventional shaft and propeller.

In keeping with the analogy drawn, we have the *Great Eastern* of 1858, the enormous ship of her day corresponding to the Sarafand of 1932, followed by the *Caronia* of 1904, pre-turbine era, and the shetland of 1944, pre-jet-propulsion era, there being a difference of 46 years and 12 years respectively in the corresponding sea and air analogous-development periods. This shows an apparent advance in air design four times as fast as that of marine design which, no doubt, is to a great extent due to scientific progress receiving stimulus from pre-war and war-time requirements, the basic principles involved being adapted to civil needs.

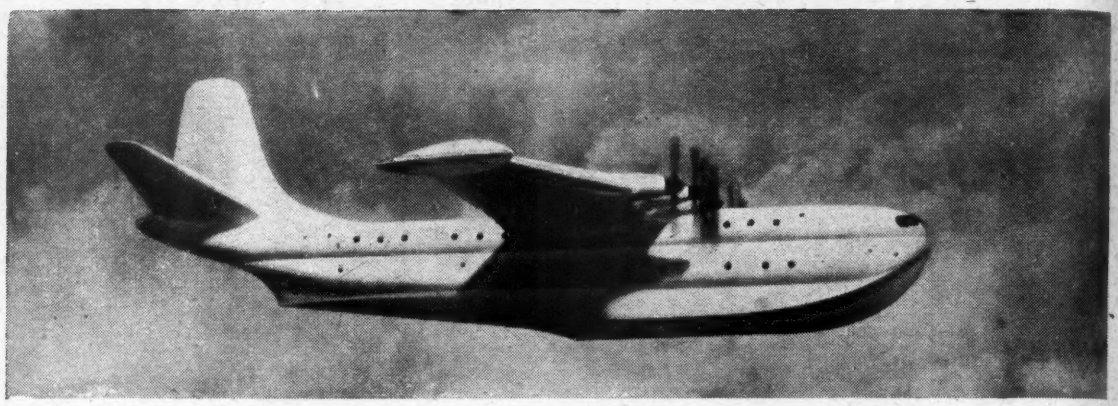
It is then, very noticeable how, over this period, each plot makes relatively the same progress; speed, weight and horse-power, generally increased both on sea and in the air in similar proportions. Figs. 1 and 2 are drawn to cover these two periods, scale being adapted so that the former clearly shows the comparison of Cunard White Star tonnage development with the superimposed all-up weight of Short's construction, the latter demonstrating a similar comparison of speed and horse-power. It is truly amazing how closely all corresponding plots follow each other.

These two graphs also show the Cunard White Star average curves in dotted lines, demonstrating with still greater emphasis the similarity in the general trend between marine craft and marine aircraft for the period under consideration.

Now, looking to the future, and assuming that the steam turbine and gas turbine analogy stands up to criti-



The Britannia, first of the Cunarders; with three near-sister ships, she was launched in 1840.



Although, of course, not a Short type, the Saunders-Roe S.R.45 is of particular interest in developing the author's theme, and has therefore been included in his graphs.

SHIPS AND FLYING-SHIPS . . .

cism, there appears to be no reason why the marine-aircraft development plot should not be continued from 1944 on similar lines, following the "average" curves shown in dotted lines. This may be termed the "theoretical progress."

Since 1944 the only two outstanding types of commercial flying-boat constructed are the Short Solent, which, like the s.s. *Laconia*, is below the average curve for all-up-weight, and the Saunders-Roe 45, yet to be launched. The Saro 45's rated power is, as may be expected, near the average curve, but her estimated cruising speed of over 380 m.p.h. is considerably in advance of the average indicated by the graph, which would appear to show rapid progress in the design of the latest airframes and engines.

At this stage it is interesting to note that opinion was somewhat divided as to the probable success or failure of the project when the *Queen Mary* and

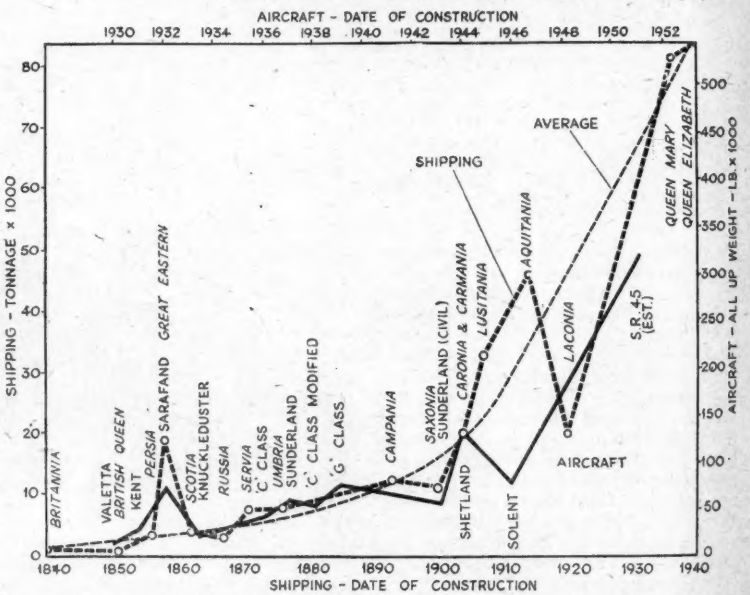
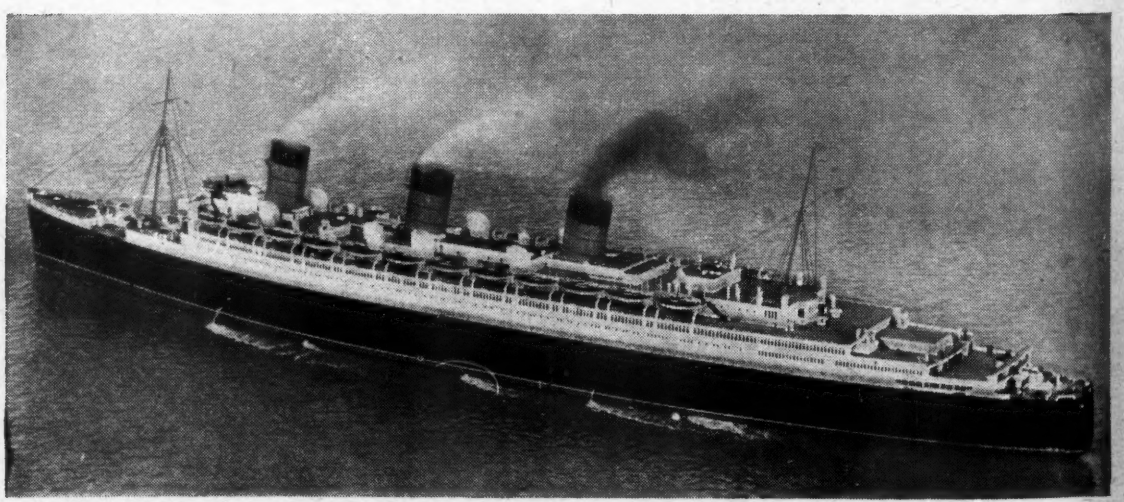


Fig. 1. Cunard White Star tonnage development plotted against all-up weight of Short marine aircraft.

(Below) First of the "Queens"—a *Flight* photograph of the *Queen Mary*, launched in 1936.



Queen Elizabeth were designed, but the Cunard White Star state:—

"These ships were built as an economic proposition and to carry on the Company's passenger business as successfully as, if not more so than, their predecessors."

Events seem fully to have justified their construction, both economically and nationally, and in this respect an extract from a speech made by the late Sir Percy Bates in April, 1941, is revealing:—

"I think the time has come for me to give more particulars on the financial performance of the *Queen Mary*. She is widely known as a masterpiece of British construction: it may not be appreciated that financially she has been very successful from the start, as the progress made in marine engineering has focused in the *Queen Mary* a new economy in transportation across the Atlantic. Since 1922, when the full effect of the U.S.A. Immigration Quota Law first made itself felt, no steamer has ever made so much money in successive twelve months as the *Queen Mary* has done since first being commissioned. The performance is all the more remarkable as right down to the outbreak of war she was confronted in her class by competition of the very fiercest description. During the first eight months, the peace months of 1939, in spite of the disturbed political situation, she actually improved her earnings over the average of the two previous years."

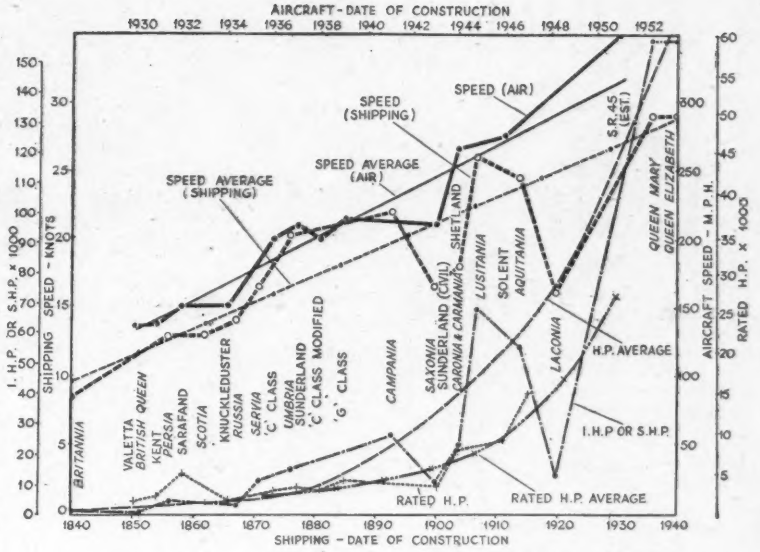


Fig. 2. Liner and marine-aircraft speed and power compared

There are many aspects to study when comparing competition between Transatlantic sea and air routes. These could best be studied separately from this broad subject of construction. It should, however, be borne in mind that marine aircraft have the following major advantages over the ocean liner:—

(1) Speedier transport, which is greatly sought after.

(2) No sleeping accommodation required.

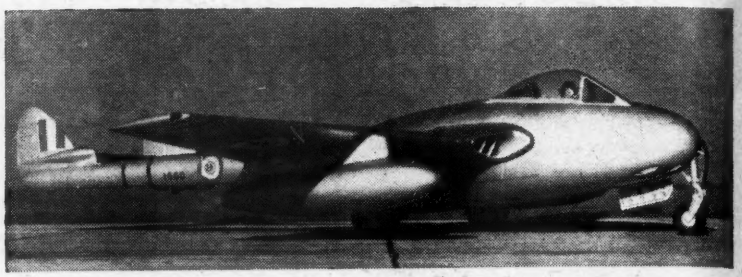
(3) Fewer meals to serve (an important factor in passenger transport).

Limitations suffered by landplanes, such as strength of undercarriages, surfaces of airports and so forth, place flying ships of 100 tons or more in a domain of their own. Moreover, there is every indication that, apart from passenger-carrying capacity, freight of a more valuable nature and increased airmail facilities will necessitate the construction of mammoth flying ships. Technically there is no stumbling block.

FLAGSHIP of the FLEET

The B.O.A.C. Stratocruiser *Caledonia* touching down at London Airport after the delivery flight from the Boeing plant at Seattle last Friday. Capt. Alan Andrew was at the controls for the flight, which included landings at Idlewild (detour to Hartford) and Shannon. *Caledonia* is the flagship of the fleet of ten 377s (six B.O.A.C., plus four originally ordered by Sweden). On board *Caledonia* was the Editor of *Flight*, who will record his impressions in forthcoming issues.

HERE and THERE



IN DEMAND: The latest country to adopt the D.H. Vampire is Egypt. A number of aircraft, one of which is shown, have been ordered, and delivery will begin immediately.

Comets for Sale

ENCOURAGING announcements of de Havilland progress with the Comet jet airliner continue to be made. On Thursday of last week the company stated that it was in a position to discuss prices and delivery dates. The first customer is, of course, B.O.A.C., whose chairman, Sir Miles Thomas, made his first flight in the Comet the same day. During a 90-minute flight, Sir Miles spent a brief period at the controls.

"Lancs" v. Terrorists

LAST week-end Lancasters were reported to have gone into action against Malayan bandits in one of the biggest operations since the campaign began. Beaufighters, Spitfires, Tempests and Sunderlands were also involved, and a total of 60 sorties made. The Lancasters probably belong to No. 210 Squadron, Coastal Command, which arrived in the Far East for a six-week spell of training. Recently, the Squadron's programme has included shipping interception practices in the S. China Sea.

HELICOPTER SPECIALISTS: S/L. F. Cable (left) and F/L. G. Meyrick, of the Airborne Forces Experimental Establishment, Beaulieu, who were called upon recently to assist in an attempt to rescue a Frenchman marooned on a buoy off Cherbourg. The aircraft, partly visible, was a Westland-Sikorsky S-51 Dragonfly.

Basic Plus

A PREVIOUSLY unstated detail of the non-stop round-the-world flight by a Boeing B-50A earlier this year was the fuel consumed by the aircraft concerned, *Lucky Lady II*. The total fuel consumption during the 23,452-mile flight is now reported to have exceeded 56,000 gall. The B-50 was flight-refuelled four times during the flight.

Air-to-Air Missile

A NEW rocket, known as the Firebird, has been developed for the U.S. Air Force by the Ryan Aeronautical Corporation. The Firebird was designed to be carried and launched by fighters, and carries radar equipment, enabling it to home on to an enemy bomber. A proximity fuse obviates the necessity for a direct hit.

Slightly over six inches in diameter, the missile is about 10ft long and has eight swept-back stabilizing fins. Flight tests have been made by the U.S. Air Force, employing an F-82 Twin Mustang with two Firebirds under each wing.

1,000-hr. Hercules

IT was announced recently that the Air Registration Board had granted an overhaul period of 900 hr to Hercules 630 engines powering Vickers Vikings operated by Airwork, Ltd. Approval was also given for a number of engines to be run for 1,000 hr before overhaul, a test which, if successful, would pave the way for a further extension of the Hercules overhaul period.

Airwork, Ltd., now announce that the first of these engines has run the allotted span, and has been stripped and found completely satisfactory. All Vikings employed on the engine trials have undergone normal servicing at Blackbushe, the home base of the Airwork charter division. The results of the trials testify to the high standard of repair and maintenance.

Successful Search

AFTER spending the previous 79 hours adrift in a heavy Atlantic sea, 18 survivors of a "ditched" B-29 Superfortress were rescued last Saturday by the Canadian destroyer *Haida*, while Fireflies from the R.C.N. carrier *Magnificent* circled overhead. The B-29, which was on its way to England, was carrying 20 men of the 22nd Bomb Group, U.S.A.F. Two were drowned when the aircraft's tail broke off on impact with the sea.

The surviving 18 had to crowd into two dinghies each intended for six men; the resulting cramped conditions, and seasickness, proved to be the worst part of the ordeal. Chocolate staved off hunger and plentiful rain prevented thirst. Shortly before the rescue, a B-17 Fortress dropped an airborne lifeboat to the survivors.

103 into 1

A DOUGLAS C-74 Globemaster of the U.S. Air Force last week carried 103 men across the Atlantic—the largest number ever to make the journey in one aircraft. Like the B-29 which "ditched" in the Atlantic, as reported on this page, it was bringing to this country personnel of the 22nd Bomb Group. This unit replaces the 43rd Group on completion of the latter's 90-day training period in Britain.

Meeting the Makers

ON behalf of Short Brothers and Harland, Ltd., Rear-Admiral M. S. Slattery, the managing director, last week entertained to dinner three members of the crew of the No. 88 Squadron Sunderland which went to the assistance

OUTLET: Model flying continues to make good progress in Germany, and many former Luftwaffe pilots are among the enthusiasts. An unconventional glider is displayed during a recent meeting in the French sector of Berlin.

HERE AND THERE . . .

of H.M.S. *Amethyst* during the Yangtse incident. The guests were G/C. J. N. Jefferson, F/L. K. H. F. Letford, D.S.O., D.F.C., and F/L. M. E. Fearnley, who joined the *Amethyst's* company from the aircraft and became its ship's doctor. Earlier in the day, the guests had taken part in the march through the City of London (see picture on p. 693).

The Great Exhibition

"NUMEROUS full-size examples of contemporary locomotives, road vehicles, aircraft and ship equipment" are promised for the transport section of the 1951 Exhibition. There will be working models of airports, and British progress in telecommunications and radar will be the subject of other exhibits in this section.

The shot-tower, the old landmark near Waterloo Bridge, is to be transformed into an exhibition feature, and it will be surmounted by a radar array with a 30ft-diameter parabolic reflector: with this apparatus public demonstrations will be given of making radar contact with celestial bodies.

International Interest

THE Australian correspondent of an American journal reports that Trans-Australia Airlines expect to put their first Avro Canada Jetliner into service by November next year. It will be used as a freighter during its trial period, says the report, which should be treated with reserve, however; present information is that Jetliners will not be available until mid-1952.

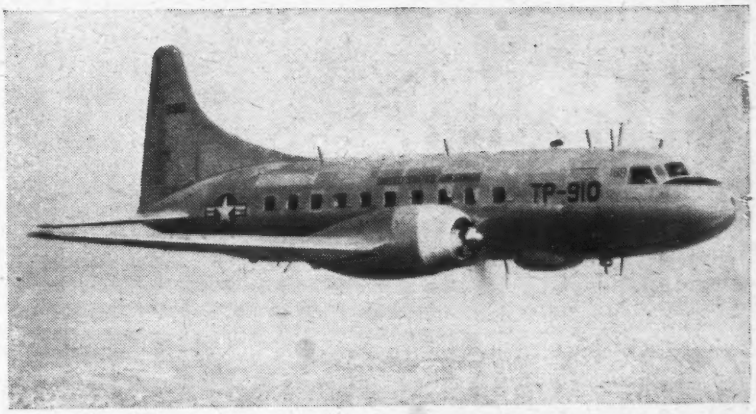
Mr. E. H. Atkin, chief designer of A. V. Roe (Canada), Ltd., in the course of a lecture before the Royal Aeronautical Society earlier this year (*Flight*, September 22nd), said that Australia, by virtue of its good weather and simple airline system, was by far the most suitable of the Commonwealth countries for the introduction of advanced high-speed transports.

Ground Engineers' Employment

IN an effort to stabilize the employment of aircraft maintenance engineers, the Aeronautical Engineers' Association has drawn up a scheme whereby an administrative board would be formed and would have the responsibility of registering, approving and certifying as competent all men engaged on civil-aircraft maintenance work.

The certified engineers would then be regarded as employees of the board and would be allocated to prospective employers in much the same way as dockers are allocated by the Dock Labour Board. On redundancy occurring at any particular airfield or works, the employees would revert to the board, which would pay them an agreed wage until new vacancies were found. It is proposed to finance the scheme by means of subscriptions from the employers and a levy on the employers' wages bills.

The A.E.A. has circularized M.P.s with a detailed description of the scheme.



PURELY ACADEMIC: Navigational training for 14 pupils (supervised by four instructors) will be provided by each of the 36 Convair T-29s on order for the U.S.A.F.; the first example of the type is shown above. A direct descendant of the Convair 240 airliner, the T-29 is equipped with four astrodomes, 18 radio antennae and a radome beneath the fuselage.

FORTY YEARS BACK

"The Vuitton-Huber helicopter exhibited at the Paris Salon has tandem lifting screws arranged to rotate in opposite directions. A third screw arranged as a propeller is intended to provide means for translation through space when the machine has once been raised from the ground. This latter propeller is of small diameter, but is driven at high speed . . . . In front of the pilot's seat is a prow to give steering-way, and behind the machine is a rudder. The frame is built in pyramid form, mostly of bamboo, which is bound throughout with tape."—*From "Flight" of November 20th, 1909.*

NEWS IN BRIEF

THE annual dinner of the Aero Golfing Society will be held at Londonderry House on Wednesday, December 14th.

* * *

Eighty per cent of the space at Olympia, London, for the Mechanical Handling Exhibition (June 6th-17th, 1950) has already been taken. The show is organized by *Mechanical Handling*, one of the journals of the Associated Iliffe Press.

* * *

A dance for past and present students of the Colleges of Automobile and Aeronautical Engineering (Chelsea) is being held at Victoria Hall, Bloomsbury Square, London, W.C.1, on Wednesday, December 7th. Tickets from Miss Sidwell, College House, Princes Way, London, S.W.19.

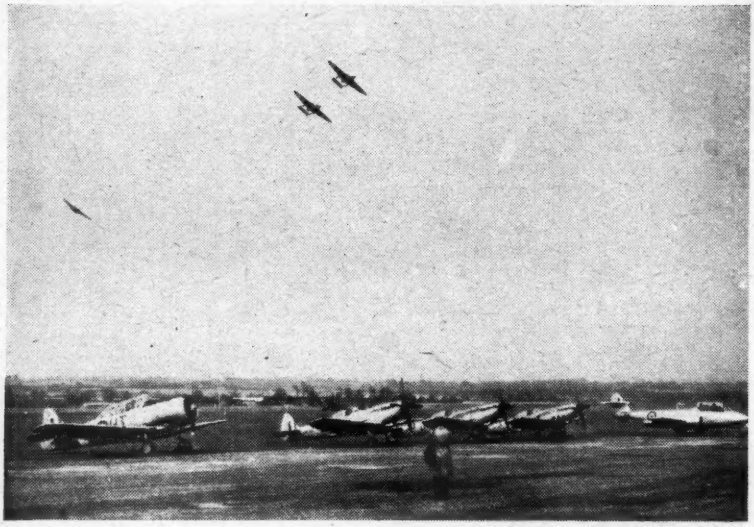
* * *

Many well-known personalities from the industry, Government departments and the Services attended a cocktail party held last Thursday evening at the Mayfair headquarters of Airwork, Ltd., to celebrate the firm's coming of age. Airwork's 21 years of operation formed the subject of an article in *Flight* of October 13th.

* * *

Mr. Frank E. Buckell, aviation manager of G.E.C., is at present visiting Canada, where he hopes to obtain orders for British airborne electrical equipment and to interest the civil aviation authorities in airport lighting apparatus. He has already secured an order for lightweight aircraft-ventilation equipment for use on Canadair Fours of Trans-Canada Airlines. Mr. Buckell is to visit the United States on his way home

CARGO SHIP: This first photograph of the Douglas C-124A reveals that its appearance, if unlovely, has the businesslike aspect of an aircraft designed to carry bulky loads over long distances. As mentioned last week (when we reproduced an artist's impression of the C-124A) the aircraft is intended to transport troops, tanks, bulldozers and other military equipment. Its designed maximum payload—for a 2,400-mile range—is 50,000lb.



"Flight" photograph.

As the Vampire 3s arrived at North Weald they passed over the Spitfire 22s which they now supersede. On the right is the Meteor 7 to be used for pilot conversion.

R.AUX.A.F. SQUADRONS RE-EQUIPPED

No. 601 (County of London) and No. 604 (County of Middlesex) Squadrons Receive Vampires

ON Friday last the first of the Vampires for the two Auxiliary squadrons stationed at North Weald arrived from Odiham. Five came in at about midday and a further two during the early afternoon. They were of the Mark 3 variety and emanated from the famous No. 54 (Fighter) Squadron, which last year made the historical formation flight in Vampires across the Atlantic.

Led by S/L. E. Plumtree, O.B.E., D.F.C., the Vampires were expected to arrive in style and put up an aerobatic display for the benefit of the new "owners." This, however, was not to be, for the weather was extremely patchy, with clear sunlight in places and areas of thick fog elsewhere. Added to these variable conditions the R/T. on S/L. Plumtree's aircraft refused to function.

To welcome the arrival at North Weald were S/L. B. P. T. Horsley, A.F.C., who commands the station and S/L. P. H. M. Richey, D.F.C., commanding officer of No. 601 (County of London) Squadron, and other officers of both 601 and 604 Squadrons.

The re-equipment with jet fighters is in line with the announced policy of making the 20 Auxiliary units into first-line fighter squadrons, and a time limit has been given for them to reach fully operational standard. A two-seater Meteor 7 is available for the pilots to familiarize themselves with the new technique of jet-fighter flying.

Both S/L. Richey and S/L. Lofts, who commands No. 604 (County of Middlesex) Squadron, are pre-war members of the Auxiliary Air Force. S/L. Lofts has had his squadron for nearly two years but S/L. Richey's appointment is a very recent one. He joined the R.Aux.A.F. as a member of No. 601 Squadron in July, 1948, and before this, up to his release in May, 1946, he had served with distinction on flying, administrative and Air Staff duties in the R.A.F., in which Service he attained the rank of wing commander. Joining the Service in March, 1937, he went into action with his squadron in the Battle of France, during which he gained his D.F.C.

"Flight" photograph.

Reception: S/L. Plumtree, right, with F/O. Hardie, F/O. McArthy-Jones and S/L. Richey, all of No 601 Squadron. Next to S/L. Plumtree is S/L. Horsley, the Station Commander.

"Flight" photograph.

S/L. Richey, in the cockpit of his new aircraft, goes over the "drill" with its late owner.

In 1941 he spent four months with No. 609 (West Riding) Squadron, R.Aux.A.F., and for three months commanded No. 74 Squadron. He followed this by taking command of No. 609, his old squadron, during the summer of 1942. It was while he was serving in No. 609 Squadron that he received a Bar to his D.F.C.

Between October, 1942, and the end of 1943, he served in India, his tour culminating with five months in command of No. 165 Wing. He also commanded No. 189 Wing, Air Command, South East Asia, in December, 1943. In 1944 he took a Senior Commanders' Course and was thereafter engaged on various staff duties. He is, perhaps, best known to the public as the author of *Fighter Pilot*.

AERODYNAMIC CLEANNESS

Increasing Importance of Detail Design : Mr. E. J. Richards' R.Ae.S. Lecture

IN his paper to be given before the Royal Aeronautical Society this evening (November 24th), Mr. E. J. Richards, M.A., B.Sc., A.F.R.Ae.S., is to review the subject of aerodynamic cleanness. The lecture is to be given at Bristol.

Mr. Richards, who is assistant chief designer (aerodynamics) to Vickers-Armstrongs Aircraft Section, will show how, in the past, aerodynamic cleanness has resulted first from a basic change in design conception (e.g., from biplane to monoplane) and, secondly, by progressive improvement in detail design.

At to-day's speeds detail design is of the greatest importance and can make or mar the efficiency of a jet airliner. Laminar flow gives by far the greatest potential gain of any individual item, though an appreciable loss of payload can occur if the wrong type of laminar-flow aerofoil section is chosen for the achieved transition position.

Severe losses arise from high induced-drag factors arising from poor nacelles, poorly designed boundary-layer fences or high sweepback, while leakage and discontinuities in profile on controls can give rise to severe drag penalties which must be taken into account when assessing the relative merits of manual and power-operated controls.

The lecturer will show that designing for good internal airflow is as important as good external design and that, for this reason, great attention should be given to intake design. With well designed intakes, ram efficiencies of over 95 per cent are attainable, a marked improvement on the 80 to 85 per cent now existing on side-intake aircraft. Cabin pressurization air, engine cooling air and other smaller items cause considerable losses in payload; thus good "inner cleanliness" on an aircraft is as important to achieve as good external characteristics. For example, unnecessary generosity in the air supply to the passengers can cause a loss of payload which is a substantial proportion of the whole.

Laminar flow on a production scale can give an extremely handsome bonus on conventional types of aircraft. Presenting one example, Mr. Richards will show that attainment of laminar flow over 50 per cent of the chord allows the payload to be practically doubled for the design range. Acceptance of the flying-wing layout increases this gain by a further 50 per cent. This advantage, however, is closely associated with far-back transition, and vanishes if leading-edge transition is assumed.

Thin Griffith wings show no advantage over normal wings, while thick suction-winged aircraft of orthodox layout present little if any advantages over normal pusher types with far-back transition. The thick suction wing principle must, therefore, be associated essentially with flying-wing layouts. With transition at the slot on the flying-wing suction aircraft examined by the lecturer, the available payload is quadrupled over the orthodox type, while the range for the design payload is increased from 4,000 nautical miles to over 10,500 nautical miles.

There is a case for the use of 30 or 40 per cent thick wings with auxiliary suction on the assumption that transition, in practice, will always be near the leading edge.

While there is every possibility that individual sheets can be made sufficiently smooth to allow laminar flow to persist, the problem of eliminating steps and waviness at joints is insurmountable at the moment and it is therefore best, in the lecturer's opinion, to aim at single-sheet transition. This means that a good degree of laminar flow can be obtained on V.C.4 types, but that the maximum limit on large tailless types is probably about 20-30 per cent chord. If transition cannot be kept to the slot, but only to 40 per cent of the chord, there is little advantage in using the suction principle. It follows that a practical suction wing must have auxiliary slots or a porous nose to eliminate the crippling effect of early transition in emergency cases.

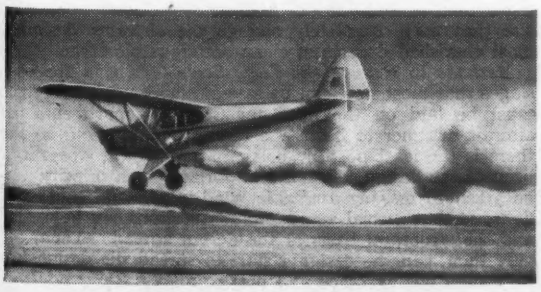
Forward slots can eliminate the adverse effects of flies, mud or rain and for this reason must be considered in conjunction with laminar flow and suction wings. A sensible porous wing construction to achieve this aim can be produced and should not carry any great penalty in weight.

CROP-DUSTING in SOUTH AFRICA

CROP-DUSTING is quite a paying proposition in South Africa. Before and immediately after the war (writes a Pietermaritzburg correspondent) most of the Union's dusting was carried out by Rapides of the Aircraft Operating Co., one of the Hunting Group. During the 1947 season, a Natal company received the contract for dusting the thousands of acres of wattle-plantations in Natal and the southern Transvaal. An aviation engineer, Harry Back, using expensive American-designed equipment as a basis on which to work, constructed an efficient dusting outfit at a small cost, and, having fitted it to a standard Piper Cub, the company set to work. At a cost of between 10s and 15s an acre, this offered the farmer an economical proposition and, since then, Cubs have been without opposition where commercial crop-dusting is concerned. Although Ansons, later replaced by a Sikorski helicopter, were used against the tsetse fly in Swaziland, they were operated entirely by the Air Force, and cannot be considered as offering the Cubs any competition.

The equipment can be installed or removed in five or six hours. The 200lb-capacity hopper is bolted-in in place of the rear seat; an agitator, rotated by a slipstream-driven windmill outside the fuselage, occupies the bottom of the hopper, the outlet being via a venturi directly beneath the cabin.

With two pilots working in relays, work usually starts at the crack of dawn, and proceeds until about midday; after this, air currents tend to disperse the dust too widely. Supplies of "dust" are conveyed by lorry to the nearest small clearing, where the aircraft refuels every five or ten minutes.



Demonstration by one of the dusting Cubs.

FORTHCOMING EVENTS

Nov. 24 R.Ae.S. : "Aerodynamic Cleanness," by E. J. Richards, M.A., B.Sc., A.F.R.Ae.S. (at Bristol).
Nov. 26. Helicopter Association : "Aero-elastic problems of Rotary Systems," by Prof. A. R. Collar, M.A., D.Sc., F.R.Ae.S.
Nov. 26. Society of Licensed Aircraft Engineers : "Electrical Remote Indication," by C. Williams, A.R.Ae.S., M.S.L.A.E.
Nov. 29. Society of Instrument Technology : "Instrumentation on the Martin Open-hearth Furnace" By G. Husson and P. Rodicq.
Dec. 15. R.Ae.S. : "Navigational Systems and Instrument Aids," by Dr. D. E. Adams, B.Sc., A.Inst.P., and Dr. A. N. Uttley, B.Sc., Ph.D.
Dec. 21. R.Ae.S. (Weybridge) : "Round the World in 90 days," film by W. Courtenay, M.M.

1950

Jan. 7. British Interplanetary Society : "The Circum-lunar Rocket," by K. W. Gatland and A. E. Dixon.
Jan. 20. London Aeroplane Club : Annual Dinner Dance.
Jan. 24. R.Ae.S. (Belfast) : "Recent Development in Aircraft Production Engineering," by Pro.. Connolly, B.E., F.R.Ae.S.
Jan. 28. Helicopter Association : "Pest Control and the Helicopter," by Dr. W. E. Ripper, F.R.E.S.
Jan. 28. Society of Licensed Aircraft Engineers : "Dowty Electro-hydraulic Systems," by Neville J. Horne.

FORGING the AIR WEAPON

Sir Frederick Handley Page's R.U.S.I. Lecture.

PART II. Future Design : Production Efficiency

THROUGHOUT the whole course of aircraft development, the Service demand has been for increased speed, load and range. To satisfy the demand for greater load and range, the designer has had, perforce, to build larger aircraft. With every increase in size comes the difficulty of combating an increase in the airframe structure-weight as a percentage of the whole. This trend, of itself, makes the structure more complex. Whilst the development and use of light alloys of higher strength have helped in keeping weight down, the increase in wing loadings associated with the higher speeds required has been a bigger factor.

The gradual cleaning-up of aircraft, first in the change from biplanes to monoplanes, then in the cleaner fairing of fuselage and power plants and in the use of the retractable undercarriage, has so reduced drag that it has been possible greatly to increase wing loadings without too adversely affecting the gliding angle, even with the higher values of induced drag that result from the higher lift coefficients obtained by the use of wing flaps. But, although structure-weight percentages have been kept more or less constant by the use of high wing-loadings, and the consequent reduction in span, the use of these high loadings has only been possible at the expense of higher landing speeds, which, in turn, have necessitated the building of prepared long runways. The immense capital outlay involved in these runways is such as considerably to restrict their future development; to construct a 2,000-yard runway may cost £250,000.

IN this paper, read before the Royal United Service Institution on November 9th, Sir Frederick Handley Page first discussed the growing complexity of military aircraft and their equipment in relation to the work of the airframe designer: this part of the lecture was reproduced in our pages last week, and in the second part, given here in very slightly abridged form, Sir Frederick takes his review of design-trends a stage further and goes on to outline the essential factors underlying production efficiency. In the lecture as delivered, various points were emphasized graphically

[At this point the lecturer showed graphically how wing loadings have increased with the passing years. From 5 lb/sq ft on the original Handley Page 0/100, he pointed out, they rose to more than 50 lb/sq ft on the Halifax, while the wing spans, which would otherwise have been increased, remain sensibly constant at 100ft for the 0/100 braced biplane of 14,000 lb, and the wartime Halifax monoplane of 65,000 lb.]

If wing-loadings are to be still further increased—and much higher values are spoken of—Service aircraft-operation will become, more and more, dependent on the availability of runways and, therefore, aircraft may lose that flexibility in operation which should be one of their main characteristics.

Such all-up weight increases, and their effect on design, can be considered as normal, and to be expected in the development of an art, but the introduction of the jet power unit, with its high power/weight ratio, has made possible so vast an increase in speed that a new series of aerodynamic and structural problems has arisen.

In the first place, if we are to avoid undue increase in drag, and use our power plant efficiently, flights must take place at greater altitude, bringing new operational problems for crew amenities and military effectiveness.

Secondly, the detail design must be much more carefully studied so as to delay, as far as possible, the onset of local supersonic velocities on aerofoil surfaces. This also entails much more accurate manufacture of the external profiles of wings and fuselage.

Thirdly, because the lift, drag and stability characteristics of aerofoils change completely as the speed of sound is approached, each new type requires to be tested thoroughly in high-speed wind tunnels, which require thousands of horse-power for their operation. For example, the original Handley Page small wind-tunnel of 1918, in which the whole of the development of the slotted wing took place, needed only 30 h.p. and gave a wind speed of 40 ft/sec. To-day, one American manufacturer operates a supersonic wind tunnel requiring no less than 20,000 h.p.

Fourthly, operation at these high speeds introduces problems of aero-elasticity, such as flutter prevention, which involve much structural research, calculation, and test.

Some idea of the new field opened up by these high-speed problems can be seen from the research work that has to be carried out to determine the characteristics of the new aircraft plan-forms now being developed. Among these forms are the swept-back wing, tailless and delta, although the last-named is more suitable for the supersonic rather than the subsonic field. If we wish to pass through the sonic barrier, and fly above the speed of sound, it is essential to use the thinnest possible wings compatible with strength, with very low values for the thickness/chord ratio of the profile.

The Douglas Skyrocket is designed for some future possible speed of 1,820 m.p.h. at 75,000ft, and has already flown at 710 m.p.h. at 26,000ft. It is interesting to reflect on the increase in complexities that comes with these new types of aircraft and to find that, although the Skyrocket was completed in November, 1947, and first flew in February, 1948, it has taken 18 months of development work to reach the present speed. It must also be remembered that this is a research aircraft and, in consequence, it may take an appreciable time before Service aircraft are habitually operated at speeds of this order.

High-speed flying leads also to aerodynamic heating, due to the great frictional losses along the surface of the wings and fuselage, and makes fuselage air-conditioning necessary if crews are carried.

Very high speeds will only be possible if turbojets fitted with afterburners are used, or ramjets or rocket units. All these give their best efficiency at much higher altitudes than have been considered so far. If crews are carried, the air-conditioning problems become somewhat of a nightmare, particularly in view of the unreliability of many of our transparent plastic materials. Emergency escape from pressure cabins also presents many difficult problems for solution.

Such are some of the new problems, with all their complexity, that lie in the path of the airframe designer. Meanwhile, equipment research workers and designers are simultaneously secretly and insidiously engaged in the development of new equipment for radar, radio, navigational aids, armament and bombs, of probable weight and size that may completely change the airframe designer's most cherished dreams of clean aerodynamic form.

Methods to Reduce the Time Scale.—It is in the early stages that most time can be saved. Once again, emphasis must be laid on the need for Service departments and aircraft designer to be in the closest co-operation, so that there is the least possible delay in settling the operational basis of the design. Equally important, high priority must be given to making available wind-tunnel and other facilities, so that special aerodynamic questions can be settled, and the structural basis of the design agreed. Then, and only then, can the designer start to spread the design load over the drawing office and make progress.

If we are to get a new type into production quickly, the

FORGING THE AIR WEAPON . . .

design must be laid out for production from the start. New methods of construction, new equipment, and new aerodynamic or control features should be tried out separately and proved, so that in a new design there are not too many experimental features. This laying-out for production from the start does not mean that every aircraft detail must have all its ancillary paper work completed for scheduling, planning, rate-fixing etc. It does mean, however, that the basis of the design and its split-up of components must be settled at the outset as that to which the design office will design; the works plan their shop layout and assembly operations; and the Services organize spares requirements, maintenance facilities and ground equipment.

For quick production, "split" construction (first introduced by the Handley Page Company in 1935), is of vital importance, as some 75 to 80 per cent of production time is spent on some stage or other of assembly. By splitting-up the aircraft and dividing the assembly work amongst many works sections, the largest possible number of men can be simultaneously employed on a single aircraft.

As far as possible, an aircraft component, completed to a certain stage, should be used as the jig for the next operation. An example of this is the way in which the Hastings fuselage is made. The detail floor parts, assembled without a jig, are given final form when the floor cover is riveted on. On this floor, as a jig, are assembled the fuselage hoops and stringers to form the fuselage skeleton. It is only in the final skinning jig that the fuselage takes its finished form. As much equipment as possible, e.g., pipelines and cables, should be installed during the early stage of component production, so as to avoid the concentration of a large number of men installing equipment in the confined space of the finished component.

Value of Photo-lofting

Having determined the component split-up, and settled, with the Service user, the equipment layout in the mock-up, the design proceeds, from aerodynamic and stress work in the technical offices to the issue of technical data to the shops. Here, considerable reduction in time is possible by improvements in the method of transmission of technical information from drawing office to works, so as to eliminate skilled setting-out. Photo-lofting methods, already applied to aircraft production, can be developed further. Full-scale drawings can now be transferred directly to the template or articles to be made, and possibilities eliminated of transposition errors and, thus, of the need for stage inspection. Still further reduction in time will be possible when draughtsmen have become more accustomed to lofting full-scale from dimensioned sketches instead of mainly, as now, from smaller-scale drawings, which virtually entail a duplication of the work.

The gain from lofting can be shown when it is mentioned that, on the Halifax, we had some 13,000 drawings, whereas with photo-lofting used on the Hermes IV there were only 6,500.

On the shop floor, the scope for improvement lies in a reduction in tooling. Simpler tooling gives a saving in the time to initial production. Methods have to be used more suitable for small-quantity aircraft production than for mass production. An extension of the use of the rubber press (for which tools can be marked out mechanically by photo-lofting) and the stretcher press will meet this requirement, since single, simple forming tools only are necessary.

Increase in wing-loading has resulted in heavy wing-skin loads, and, therefore, in plated rather than skinned wings. The weight of such skins becomes an important item in the airframe structure. Consequently, in the very highly loaded wings the skins are taper-milled, so that their thickness is kept throughout the span to the minimum required. The light-alloy sheet manufacturer, however, has a part to play in rolling sheets of much larger sizes than are at present available in this country.

These methods are taken by way of example of how, in the shops, the problem is being studied with a view to reducing the time-scale of production. The greatest saving in time can probably be made in test flying. The total number of actual flying hours for an aircraft to complete its tests may be relatively small, but, with delays due to bad weather, and with modifications to be carried out as the result of tests, the elapsed time may be considerable. It always seems to happen that when the weather is good the aircraft is unserviceable because a modification is being carried out, and *vice versa*. Equally, it always seems that a new type is ready to start on its trials in the winter, and that most flying is urgently required to be done on Christmas Day, or some other holiday period. What a time saving could be effected if we were able to transfer here the weather of California!

Some Conclusions to be Drawn.—The design and development of aircraft does not proceed at a normal pace throughout the years. At certain periods, under the stress of international crises, an impelling urge forward causes completely new theoretical possibilities to be translated into accomplished fact. So, in the past, we have seen the higher speeds reached in the change from biplane to monoplane, the great increase in size of aircraft in the two world wars because of the increased bomb loads to be carried, and, finally, we have the great leap forward that has been made possible by the jet unit with its higher power and low weight.

With this high power/weight ratio the operational field is so extended, both in speed and altitude, that not merely have we to make great advances in design, but, equally, to make almost revolutionary changes in equipment which the aircraft has to carry. Thus, we are faced with a situation that demands developments quite at variance with Lord Northcliffe's dictum, "Never make an experiment on an experiment"; for a new type of aircraft, to-day, with its new types of equipment, seems to be nothing but a collection of experiments.

It is difficult to ensure that all those who specialize in the different branches of science and engineering which are drawn upon for the make-up of an aircraft possess an equal awareness of the aerodynamic and structural implications of their own particular contribution, and of the consequences that result from oversized or overweighted equipment; and it is equally difficult to get them to forgo what are in fact non-essential refinements to make more certain the operational success of the whole.

The collaboration of Service user, designer, and producer in mock-up conferences, and in the installation of equipment relative to the component split-up, are valuable for ensuring a proper balance in new design. This procedure could without doubt be extended with advantage by the participation of the equipment designer, so that he might view his equipment from the background of the aircraft designer.

If the aircraft designer is confronted with the problem of installing equipment unalterable in weight or dimension his scope for aerodynamic or structural development is clearly limited and, in fact, the very attainment of the essential purpose of the aircraft may be jeopardized.

Prototype Production

If we are to keep within reasonable bounds the time-lag between initial conception and final flight realization, the method of producing experimental aircraft must be greatly simplified in comparison with the methods normally adopted for quantity production. With all the complexities in the aircraft and its equipment, the supervisory and design functions of both supplier and purchaser become widely spread in a host of departments and industrial organizations; correlation thus becomes more and more difficult, the time between decision and action extends, and unity in realization is difficult. It is a matter for consideration whether, if urgent action is required, aircraft experimental development should not be concentrated primarily around the article to be completed, rather than on a wide devolution and decentralization by function of its constituent elements. Thus, the Handley Page Company, in October, 1917, was instructed to design a bomber of 30,000 lb weight (the V/1500) which was twice the size of the exist-

FORGING THE AIR WEAPON . . .

ing 0/400. This aircraft was built and flown in the record time of seven months. It is true that construction then was much simpler, but the official and industrial control of the project was concentrated in what may be termed a small committee of official, technical, contract, and industrial representatives, whose *sole* job was to carry to completion the work of designing and building the aircraft. And they were given plenary powers to carry through the work.

Such a system finds a comparable organization in an experimental department in a works, where experimental drawing office, shops, buying department and contract office are all located in a small unit capable of taking immediate action on any problem to be solved.

Over the whole picture comes the shadow of weight. For everything that is in the aircraft must be carried into the air against the force of gravity: considered on the broadest lines, Air Force operations are, in fact, mountaineering operations conducted at heights up to and far exceeding those of the Himalayas. Everything, therefore, must be considered as though it were required to be the equipment for a mountaineering expedition.

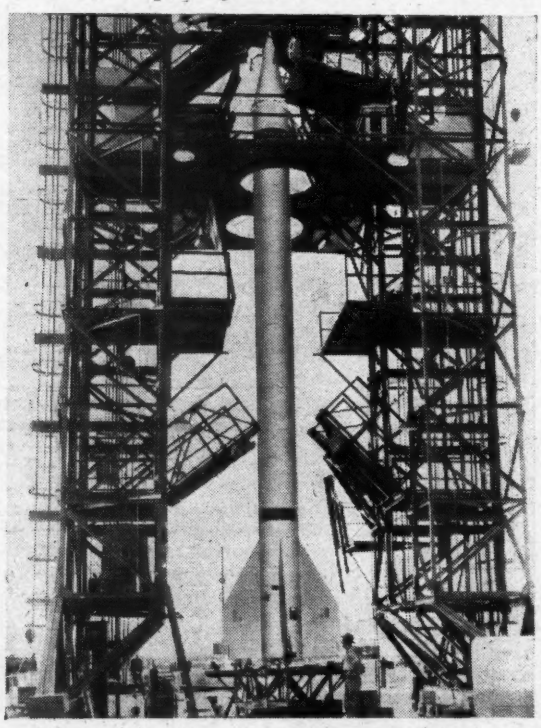
Every saving in weight has a cumulative effect on the final aircraft design and its overall efficiency. For a design to a specified performance, any decrease in crew or equipment decreases the all-up weight, and this again allows both wing area and power-unit capacity to be reduced with a consequent still further decrease in all-up weight. The resulting aircraft can be built smaller, lighter in weight, and probably also cleaner in form, and should be cheaper to build.

Above all, the human contribution is the most important. If it is necessary to save in equipment weight, it is still more necessary to save on the number of the crew that have to be employed. In view of the many varying types of equipment that have to be carried, it is essential that as much as possible should be automatic in action. Equally well, the crews should be highly trained with capacity for carrying out a great variety of duties. Such standards can only be attained by those who serve for a long period so as to get the necessary training. Correspondingly, if the aircraft and its complex equipment is to be kept in first-class condition, there must equally be first-class personnel on the ground. Whilst industry can make a contribution in the pre-training of apprentices prior to their National Service, the maintenance skill and knowledge necessary for the efficient operation of these highly finished products can only be acquired by long Service training.

Whatever future developments may hold in guided missiles, push-button warfare or other scientific dreams, the human element must always be the dominating and directing factor, and it is only by continuous training and development that the highest attainment can be achieved in design, production and operation.

RESEARCH by ROCKET

UNDER a U.S. Naval programme, aimed towards the development of an American high-altitude rocket to surpass the performance of the German "V-2" (A-4), ten Viking rockets are being assembled by the Glenn L. Martin Company. The first of these missiles, launched from the White Sands proving ground in New Mexico, attained a height of 51½ miles and a speed of 2,250 m.p.h.; the second, incorporating certain modifications, was then assembled at Baltimore. The development programme provides that experience gained from each will be used to advance the design of the next, and all succeeding, rockets of the series.



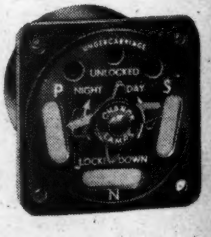
The Wellsian prospect of a Viking in preparation

Though originally conceived as a vehicle for carrying research instruments into the upper atmosphere, the Viking should materially advance the whole guided-missile art. Forty-five feet long, it weighs five tons and burns liquid oxygen and alcohol in a rocket motor developing ten tons of thrust for more than a minute. The first example was subjected to two static firings, in which it was checked, fuelled and fired as for a flight, but was securely fastened to its launching stand. By this means minor defects were corrected before the Viking departed on its 51½-mile, 163-second ascent. Having climbed 15 miles under power, the Viking coasted to its zenith, before returning to earth 10 miles away, about six minutes after take-off.

MINIATURE UNDERCARRIAGE-INDICATOR

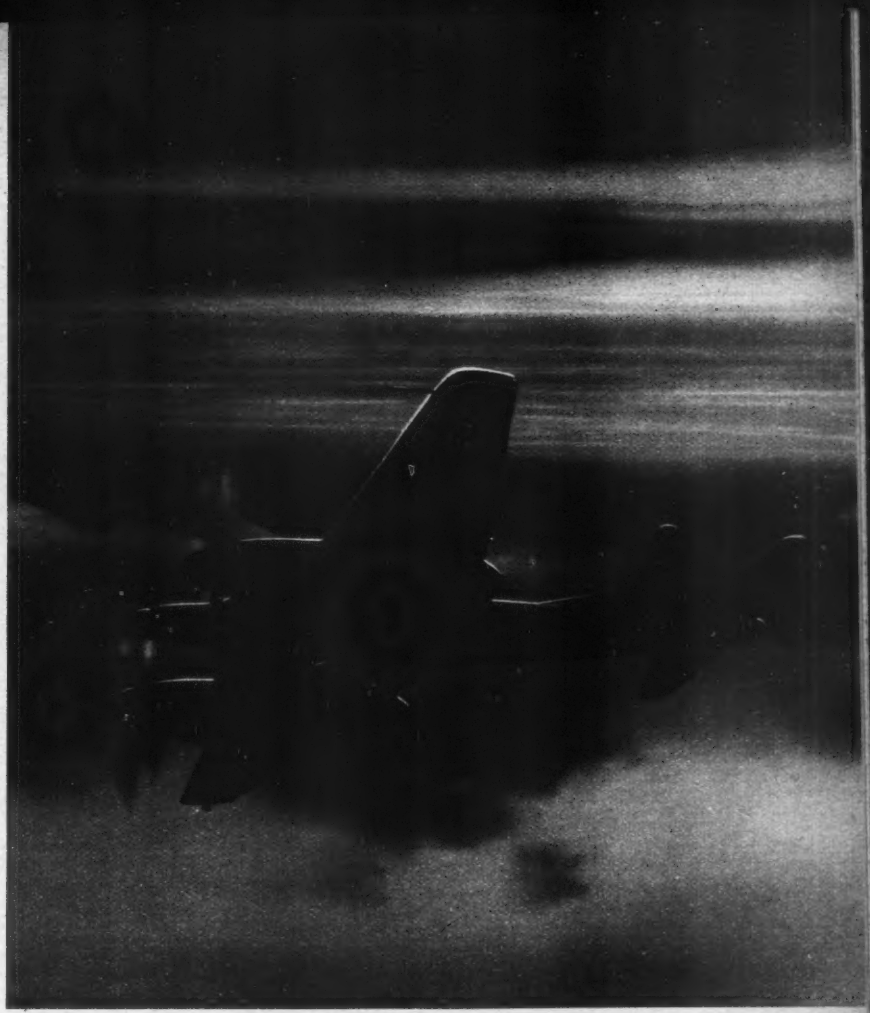
EXCEPT in the case of failure, many minor but indispensable components of an aircraft are taken very much for granted. Such an item is the undercarriage position-indicator, to which some attention has been drawn, however, by the recent announcement that all future Service aircraft will be equipped with the new Dowty C.1224-Y miniature indicator. Existing aircraft are being fitted with this instrument as wastage occurs.

The new equipment has the standard S.A.E. case for miniature instruments, occupies only half the dashboard area of the previous indicator, and weighs 8oz—a 50 per cent weight-saving. It is weather-proofed to M.O.S. requirements, and the facial arrangement is adaptable to all types of undercarriage. The method of operation is identical with that of the standard type, with the exception of a new switch manipulation system (for day and night screen and lamp-change) which gives greater ease of working to gloved fingers. For lamp replacement, the complete interior of the instrument is removable at the turn of a screw; grooves in the casing preclude any chance of incorrect assembly.



Half-scale reproduction of the new Dowty instrument.

NAVAL NIGHT FIGHTERS



Men, Machines and Modus Operandi of No. 809 Squadron, Naval Aviation

By C. B. BAILEY-WATSON

Illustrated with "Flight" Photographs

IT is a simple truism that air defence to-day is dominated by radar ground-control interception. Without G.C.I. the Battle of Britain could not have been fought as it was fought, let alone won. And just as G.C.I. made effective fighter defence possible during the day, so did a further application of radar—A.I., or air interception—later make possible the effective operation of fighters at night.

On this foundation it is patent that the effectiveness of defence is dependent on (a) the quality of the radar and radio equipment, (b) the efficiency of the ground controllers, (c) the skill of the pilot (plus, in the case of night fighters, the working efficiency of the pilot and observer team), and (d) on the performance of the aircraft. This order of importance is a subject for argument, but in that the factors are to some extent mutually inter-dependent, the matter is chiefly of interest to the strategists and tacticians, and need not concern us here. It is, however, easy to deduce that, if the tools are not matched to the skill of their users, the potential effectiveness must inevitably suffer. Taking men and training for granted so far as quality is concerned, therefore, it stands to reason that air defence is ultimately a matter of equipment, for if the radar sets and the aircraft are not up to scratch, no matter how good the men are, the defence system is just that much more vulnerable. From a national viewpoint, this is a fortunate balance of factors in that man has so far kept the mastery of his machines, but, until the contrary obtains, the demands for ever-increasing quarts out of lighter and handier pint pots will continue to plague the aircraft designer and radar scientist.

Both radar equipment and aircraft design in their latest forms are, very properly, subject to security secrecy, and there is thus not much that can be said about them. These are matters of the future, however, and in terms of what now exists in squadron service the restrictions are by no means so stringent. Before going on to deal with these aspects it is, one feels, perhaps more apposite to give a brief review of the background of naval night fighting, and to make an equally brief survey of squadron history.

Eight years ago the Admiralty decided that the Royal Navy ought to have night fighters: a sensible and inevitable decision in that, just as cities, airfields and strategic targets on land need air defence at night, so do ships at sea, be they in fleets, convoys or flotillas, need similar protection. More, in fact, for enemy aircraft which might not, in the event, deliver attacks, could well be acting as shadowing air observation posts for submarines. In 1941, therefore, a group of naval officers took a course on night-fighter work with the R.A.F., and thereafter set up a small night-fighter training school at Drem, Berwick. Here, pilots and observers were instructed in the use of A.I. equipment and were crewed-up as teams. The Squadron, No. 784, employed Ansons, Fulmars and, later on, Fireflies.

Training began in earnest in October, 1942, and continued uninterrupted until 1945 when the squadron moved to Dale, Pembrokeshire. The following year, however, naval night-fighter training was stopped and the squadron disbanded; work was not resumed in this sphere until last

Formation practice high in the Cornish sunshine.

NAVAL NIGHT FIGHTERS . . .

year, when the present night-fighter school was formed as No. 792 Squadron at R.N.A.S., Culdrose. Firefly night-fighters have, however, been maintained in H.M.S. *Ocean* with the Mediterranean Fleet.

On the same station—H.M.S. *Seahawk*—as No. 792 is based the Royal Navy's chief first-line night-fighter and night-strike squadron, No. 809. Formed in January this year, under the command of Lt. Cdr. J. O. Armour, R.N., the squadron is individual not only in its work but also in its complement of aircraft—eight instead of the more usual twelve—and, too, in the aircraft themselves. These are Sea Hornet 21s, the only two-seater versions of the Hornet to have been built. It is, of course, essential to have a skilled radar operator to direct the pilot, and in the Mk 21 a second cockpit is embodied about half-way down the fuselage where, beneath a teardrop bubble canopy, the observer sits facing aft. The fact that the observer is facing rearward and that no electronic conversion is fitted in the scanner/scope system is a matter which makes the observer's job extremely confusing until he gets used to it. It is difficult for the observer to forget that he is travelling backwards, particularly when the pilot says there is something to port and the observer has, therefore, to look to (his) starboard. Yet he must remember to tell the pilot to turn to port when attacked from port that is to say, when he is interpreting the picture shown on his A.S.H. scope, he must forget he is travelling backwards, because the indications are not reversed.

In such work, where the pilot is flying blind on the directions given by his observer, it is essential that each should be fully conversant with the other's method of operation. For example, the pilot should know whether his observer tends to exaggerate, or equally as important, to minimize, and whether he tends to give too many or too few directions and corrections; conversely, the observer will do a better job if he is familiar with the idiosyncrasies of the pilot—whether he reacts rapidly or slowly, is excitable or placid, is a cautious or "press-on" type.

It is by no means unusual for ground staff to attach nicknames to aircrew, and with eight pilots for eight aircraft it was, perhaps, a "natural" for the C.O. to become Snow White and his pilots the Seven Dwarfs. Each aircraft carries the appropriate Disney character on the nose but no ready-made pseudonyms are given to the observers; maybe it is that pilot and observer are regarded as an indivisible duo. Whilst on the subject of allegory, it is pertinent to observe that the squadron insignia is a Phœnix rising from the flames above the motto "Immortal." In that the present 809 is the third formation to bear the number since 1941, it would appear that their blazon is somewhat more apposite than frequently is the case.

The original squadron, operating from H.M.S. *Victorious*, took part in the Petsamo raid and in escort duty to Russian convoys during 1941, thereafter operating in the Mediterranean during the following year. When *Victorious* returned to the United Kingdom, the squadron was disembarked and underwent a spell of training in Army co-operation work; this, however, was short-lived and, again in company with *Victorious*, 809 played their part in the North African landings. Having returned to this country, the squadron was disbanded. In 1945, the Phœnix rose again at Nutts Corner, Northern Ireland, and, after working-up with Seafire aircraft, the squadron embarked for the Pacific. By the time they arrived at Trincomalee, however, the second atom bomb had been dropped at Nagasaki and the Japanese had surrendered. The squadron then returned to the United Kingdom and was again disbanded, this second eclipse lasting until January 20th this year, when the present Commanding Officer was posted to Culdrose with the task of re-forming the squadron.

Again unusually, at the time of his posting, Lt. Cdr. Armour was a Major in the Royal Marines; one of the small band of that distinguished corps who fly, he did not, in fact, transfer to the Royal Navy until some few months ago. As a Marine officer aboard ship in the Mediterranean during 1941, John Armour felt that there was a better job to be done in the air, and he applied for flying duty. After training at Luton and in Canada, he returned to this country (O.T.U., Yeovilton) and was then posted to the night-fighter training squadron at Drem.

Four 60 lb rockets can be carried under each wing.

Drop-tanks can be re-fuelled with the wings folded.

Lt. Cdr. Armour poses his Sea Hornet—with the writer in the rear seat—for the benefit of John Yoxall.

Since that time his whole operational flying life has been concerned with night fighting.

He went on a mission to the U.S.A. in 1943 (as a result of which the Royal Navy got A.S.H. sets and Hellcats equipped with A.I.A.), and then operated with the R.A.F. from Ford in defensive night fighting, and from Wittering in offensive intruding. Thereafter, he was instructing at Drem until April, 1945, when he was posted C.O. of 892 (Hellcat) Squadron in H.M.S. *Ocean*. On returning from the Mediterranean, he was given command of the naval night-fighter school at Dale, thence going on a night-fighter leader's course at West Raynham, and staying on as a member of the school staff (tactics branch) for two years. This was his last appointment before being given command of 809.

The equivalent of a shipboard "Jimmy the One," Lt. D. R. O. Price, D.F.C., is Senior Pilot of 809. He also trained in Canada, was posted to 816 (ex-*Ark Royal*) Squadron which, attached to R.A.F. Coastal Command, operated their Swordfish from Thorney Island on anti-E-boat sorties, mine-laying and torpedo striking—all at night—in Channel waters. Then 816 went to sea in H.M.S. *Dasher*, an escort carrier engaged on Russian convoy duty. This was the ship that, returning to the Clyde after enduring terrible gales in the northern seas, blew up off Arran. Price was one of about 120 out of the ship's company of 500 who survived. He then went to Drem for the N.F. course, thence being loaned to No. 29 Squadron, R.A.F., for a year, half of which was spent on night-fighter work, and half on night-intruder operations.

After visiting the United States to demonstrate the Firefly night fighter to the U.S. Navy, Price came back and was attached to the Ministry of Supply for two years on loan to Vickers-Armstrongs for development flying in armament research. The 12 months preceding his present posting were spent with the Aircraft Torpedo Development Unit.

Price, incidentally, as chief dwarf, is "Doc." Lt. J. F. Maddocks is "Sneezy," Lt. D. M. Rouse "Happy," Lt. F. C. Musgrove "Bashful," Lt. N. Ducker "Dopey," Lt. P. L. McDermott "Grumpy," and Lt. A. A. Knight "Sleepy." We take no responsibility for linking these names—as they say in films "any resemblance is purely coincidental." For our own part, having flown and eaten and drank with the squadron we should be inclined to label them all "Happy." The senior observer is Lt. H. E. Hunt, who normally flies with Lt. Knight. The C.O.'s observer is Lt. W. J. Carter, a notable rugger player who recently was selected for Cornwall in their game against Somerset (the squadron firmly believe that Carter may well be selected for the Navy XV this season). Lt. F. W. Burgess flies with Price, Lt. A. G. B. Phillip with Maddocks, Lt. O. J. Roe with Rouse, Aircrewman T. E. J. St. Vaughan with Musgrove, Lt. D. Christley with Ducker,

When this very close-close-up was taken, the aircraft were at 6,000ft.

All servicing is done for the Squadron by the Squadron.

NAVAL NIGHT FIGHTERS . . .

and Lt. T. C. S. Leece with McDermott. In addition to the 16 aircrew members, the squadron comprizes—as a self-contained mobile unit—about 84 P.O.s and ratings, so that the total personnel establishment is of the order of 100.

During these first months of the squadron's present (but third) existence, the working-up programme has been divided into three stages. Stage 1 comprised familiarization with the aircraft; day and night formation flying; day and night all-weather flying, and day and night navigational exercises. Stage 2 comprised air-to-air camera-gun and gyro gun-sight training; air-to-ground cannon- and rocket-attack training, both day and night; ground strafing at night, and night intruding. Stage 3, which is now being completed, has been concerned mainly with day and night air-interception under G.C.I. direction; practice night intruding; straight night fighting against bombers (and these can be organized); carrier drill and addles (Airfield Dummy Deck Landings); stream take-offs and landings. When this last phase is completed, and the Deck Landing Control Officer and Flag Officer Flying Training are satisfied with the addles, the squadron will do actual deck-landings. In this connection, although all the squadron pilots have had carrier experience, none of them, at the time of our visit, had deck-landed a Sea Hornet.

The sequence of squadron training has suffered in some respects by the number of air displays during the summer at which they were required to give demonstrations; it all provided useful training in formation flying and aerobatics, however, and we can testify from personal experience that 809 are by now thoroughly familiar with their aircraft. Lt. Cdr. Armour gave us a ride during formation practice one afternoon, and extremely interesting it was. The business of ensconcing oneself in the observer's cockpit is something which itself needs a deal of practice. Entry is gained through a trap-door in the floor of the fuselage, into which one levers oneself backwards to kneel whilst lowering the folding seat. Someone then hands up the dinghy pack which one places in the seat-pan, and then comes the serpentine sequence of twisting oneself up and turning round at the same time in order to sit on the dinghy. The dinghy is clipped to the parachute harness; Mae West inflation-tube connected; safety-harness secured; intercom. plugged in; oxygen connected (if necessary); and that is that. For emergency exit the bubble hood can be jettisoned by pulling a handle beneath the port rail. The door in the floor can likewise be jettisoned by pulling a handle on the flank of the fuselage just above the door on the port side. In this connection, we were told that emergency exits had been made in 11 seconds. Youth is supple and anno domini takes its toll so that, whilst agreeing that fear can lend the most surprisingly powerful wings, we were glad that we were not called upon to try to get out in a hurry.

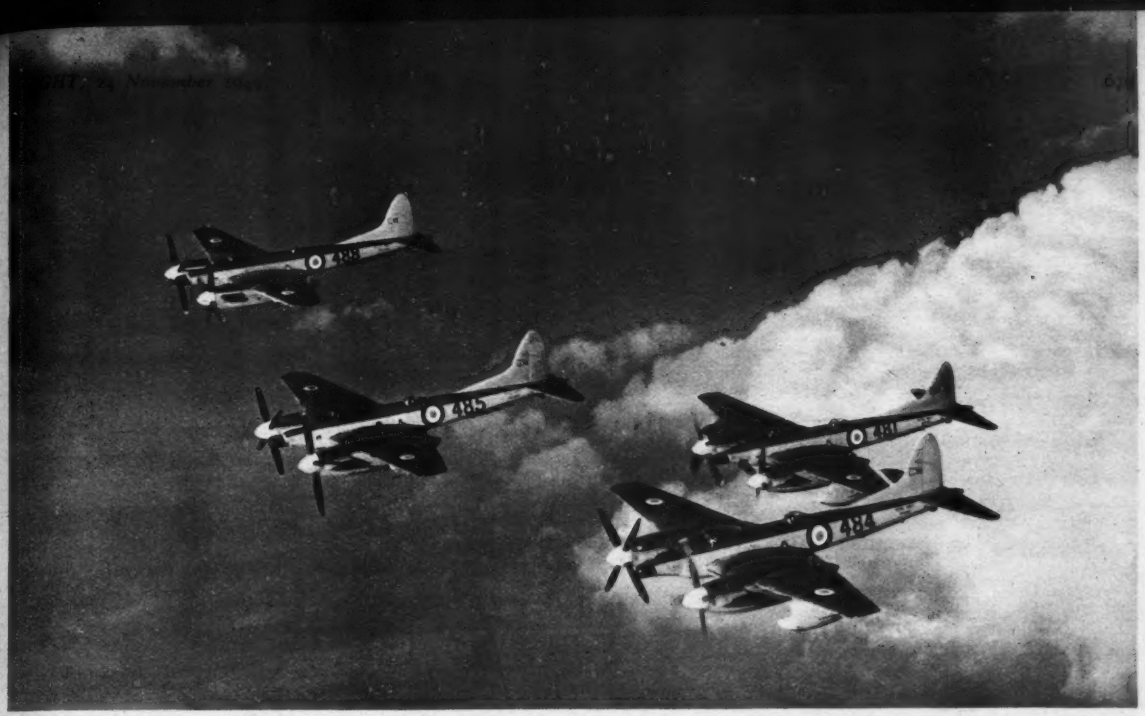
Serviceability is chiefly a matter of radar serviceability.

For the benefit of John Yoxall (who was photographing us from a Firefly) the C.O. laid on a little piece of demonstrative flannel. With "Doc" Price to starboard, "Grumpy" McDermott to port and "Dopey" Ducker in the box, we flew steadily at 170 kt I.A.S.; then the C.O. ordered "Stand-by to feather one," and again, after a short interval, "Stand-by to feather—go." And each aircraft, except Ducker's, feathered an airscrew. Then after a few moments, Lt. Cdr. Armour feathered our starboard airscrew as well, and there we were, gliding smoothly at 150 kt I.A.S., without fans, whilst to the writer's somewhat apprehensive eyes, Ducker's pair of 12ft-diameter airscrews were thrashing round twitchily close beneath.

We were also able to spend a profitable evening at the G.C.I. post down on the coast, whilst the squadron were getting in some night-interception practice. Aircraft are told off in pairs for this and alternately operate as "enemy" and "defender." The ground-controller takes them about 15 miles apart and then controls the defending aircraft on to the enemy according to the picture shown on the plan position indicator oscilloscope. In order to decrease the possibility of accident as much as possible, groups of aircraft are separated by 3,000-ft intervals, whilst a separation of 500ft is maintained between individual

Aircrew, left to right: McDermott, Rouse, Burgess, Price, St. Vaughan, Musgrove, Furgeson, Leece, Dutton, Christley, Roe, Ducker, Carter, Phillip, Armour, Maddocks.

Groundcrew, with C.O. As a self-contained mobile unit, the Squadron has a total personnel establishment of approximately 100, covering all requisite trades including cooks and stewards.



Fantastic formation: but despite the adage " never feather both together " (particularly with one in the box) it makes an unusual picture.

defender and raider aircraft. From their initial positions at roughly 15-mile separation, the defender and enemy each fly on vectors given them by the ground-controller. When they have been controlled to a separation within the capacity of the A.S.H. set and, therefore, the defending observer should be able to pick up the enemy aircraft on his scope, the ground-controller says " Punch " ; in answer to this, when the observer does, in fact, pick up with enemy, he replies " Judy, Judy." Hearing this, the ground-controller ceases to issue directions although, of course, he will do so if, for any reason, the observer gets into difficulties and requires assistance.

Having made A.S.H. contact, the observer then transmits a running commentary of instructions to his pilot, and it was quite fascinating, having watched the " blips " on the P.P.I. coming slowly nearer to one another, to follow the sequence of the attack. In the gloom of that remote room, where the fluorescent sweep on the P.P.I. screens gave a ghostly luminance and the background hum of electrical equipment was interrupted only by the quiet, brief instructions of the controllers, one felt oddly close to the men flying 20 miles away, 10,000ft above the sea.

We heard the controller say " Punch " and then, almost immediately, over the loudspeaker came an excited " Judy, Judy." Thereafter, we heard the instructions " Dead ahead, dead ahead; range 5,000, five above [i.e., five degrees]; starboard gently; steady; range 3,000, 10 above; range 2,500, five above; dead ahead; range 1,500, five above; dead ahead; five to port, five to port; range 1,000, decreasing slowly; dead ahead, five above; dead ahead still, five above; range 800, 10 above; five above; dead ahead still, five above; range 800; throttle right back (pilot repeated instruction); dead ahead still, range 700." " Righto," answered the pilot, " breaking off." Then the controller got to work again giving new vectors.

The concept of night fighting as at present envisaged embraces the method of pursuit and attack just described but, in warfare, the pilot would not normally fire his guns until he had visually identified his target. It is, of course, conceivable in all-weather flying, whether by day or night, that conditions might make it impossible for the final visual check to be made, and in such circumstances, although the final responsibility rests, as ever, with the pilot, the ground-controller may well be sure beyond reasonable doubt that the quarry *is* an enemy and might then give the assurance to the pilot that he could attack blind. The I.F.F. (identification friend/foe) system fitted to our aircraft during the war gave a large measure of security against internecine attack but, as with all man-made devices, there comes a time when one of the bits and pieces fails, and in such circumstances the general rule of visual identification before attack would at least lessen the likelihood of subsequent remorse.

For strike navigating duty, the aircraft actually forming the striking force would be navigated by one, or perhaps two, Sea Hornet 21s with, of course, the escorting fighters providing top, bottom and boundary cover keeping the main force in view. The strike commander plays a lone rôle in that it is his job to make an initial assessment of the situation, to keep out of trouble and, if necessary, to make *ad hoc* alterations to the briefed plan of attack as may appear desirable in the light of the obtaining conditions. Strike navigating over considerable distances devolves almost entirely on the skill of the navigating observers. A.S.H. will give good returns in much the same manner as A.S.V. and H_2S up to quite reasonable ranges, although, as with all marine radar equipment, sea conditions affect the quality of returns. Reconnaissance, as another 809 duty, is straightforward in that it is simply a matter of going and having a look at, or for, something suspected by the Admiral commanding the Fleet.

We have already referred briefly to the Sea Hornet 21 and touched upon the provision of the observer's cockpit. For night-fighter duty the aircraft carries the standard four 20 mm cannon under the pilot's cockpit, whilst as a strike aircraft it can carry up to eight rockets, double-banked on the four zero-length rails, and either two 500 lb or 1,000 lb bombs. Alternative to bombs, drop tanks of 100 or 200-gallon capacity can be slung beneath the outer wing panels which, of course, are fitted with hydraulic power-folding gear. A neat design point is the provision of filler holes in the base flanks of the drop tanks as well as in the top, so that the tanks can be filled with the wings folded. Vital statistics for the Mk 21 are as follows:—

D.H. SEA HORNET MK 21 DATA

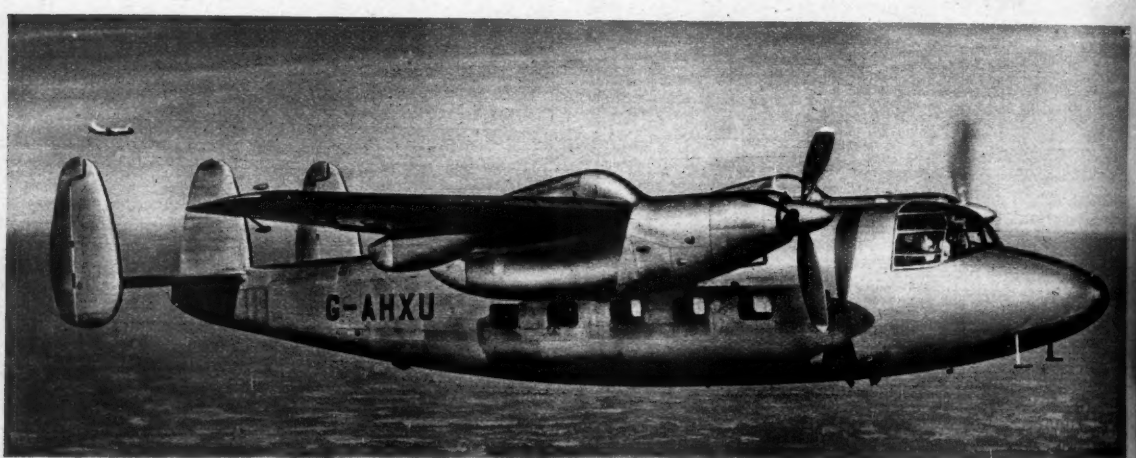
All-up weight	19,360 lb
Tare weight	14,000 lb
Wing loading	61 lb/sq ft
Tankage	360 gallons plus 200 or 400 gallons (drop tanks)

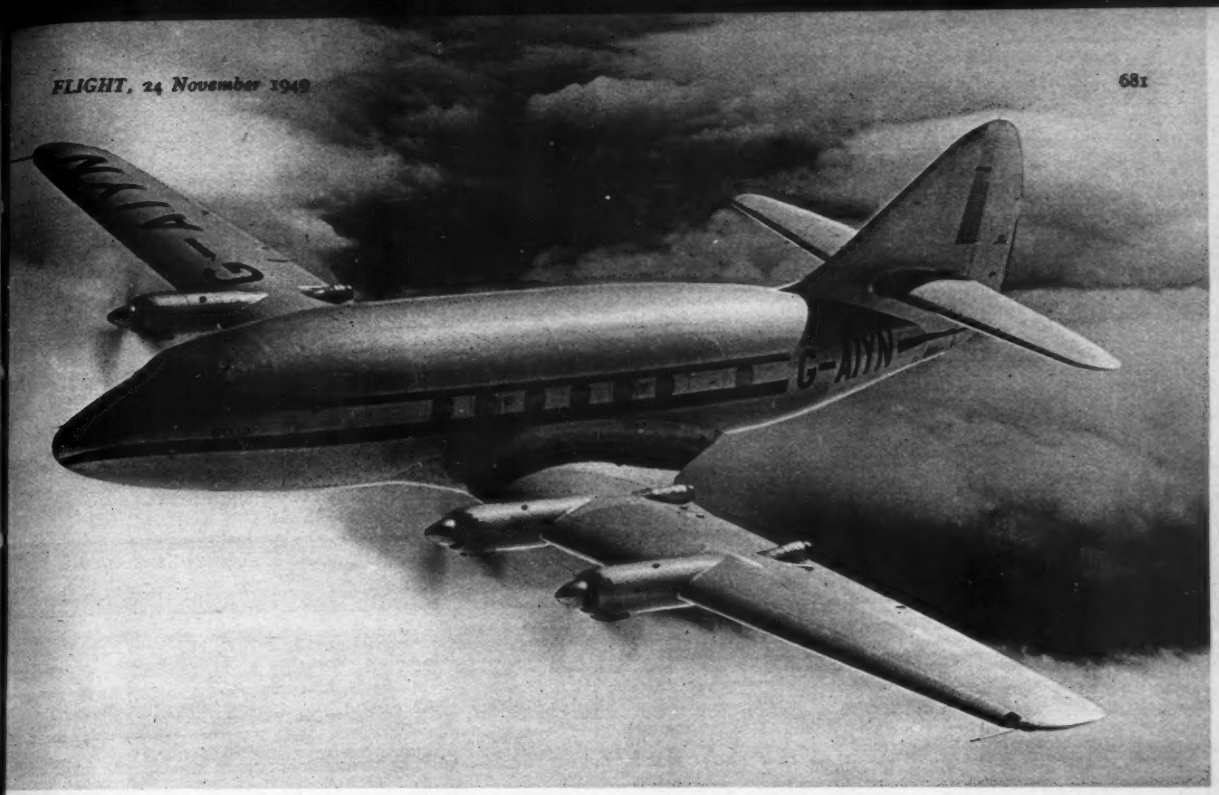
Performance at 15,790 lb

Max. speed at sea level	333 kt
Max. speed at 22,000ft	402 kt
Max. speed at 30,000ft	387 kt
Climb at sea level	4,650 ft/min
Climb at 30,000ft	1,900 ft/min
Operational ceiling	37,500ft
Normal range at 30,000ft	1,300 nautical miles

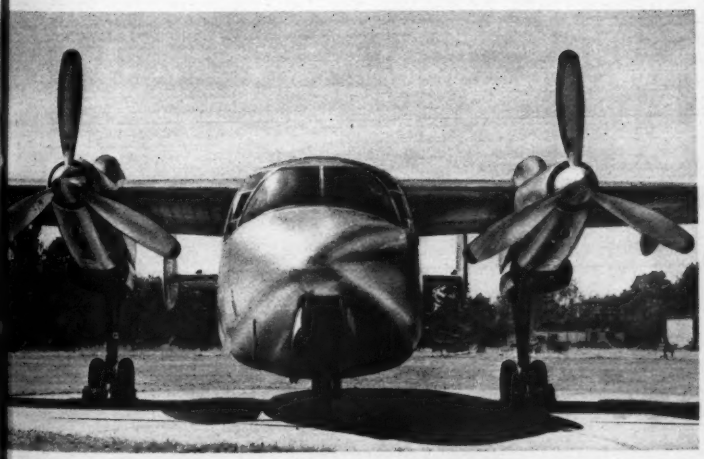
MAMBA POWERED

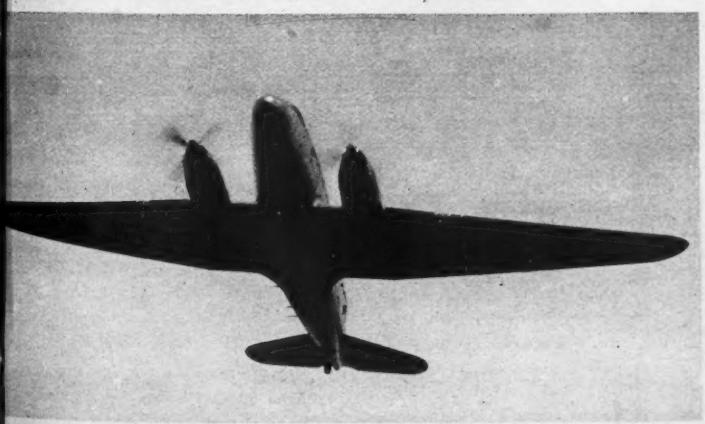
THREE widely differing types of civil aircraft with one feature in common—their Armstrong Siddeley Mamba turboprops—are depicted on these pages. Each one has its own outstanding characteristic, and all have a lively performance, especially on the climb. To a great extent it is the remarkable compactness of the Mamba installation, together with low weight and an aerodynamically clean exterior, which makes it suitable for installation in such a variety of aircraft, both civil and military. To the right are studies of the Armstrong Whitworth Apollo; the centre horizontal strip shows the Handley Page Mamba-Marathon; and below it is the experimental transformation of the well-known Dakota. The two new prototypes are now well advanced in development, and of the Mamba-Dakota it is learned that first performance checks have indicated close conformity with the performance estimates given in *Flight* of September 22nd. A Convair 240 has crept into the photograph of the feathered Marathon.

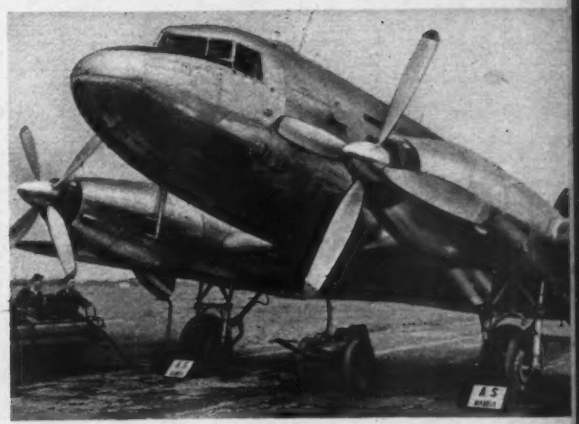




"Flight" photographs



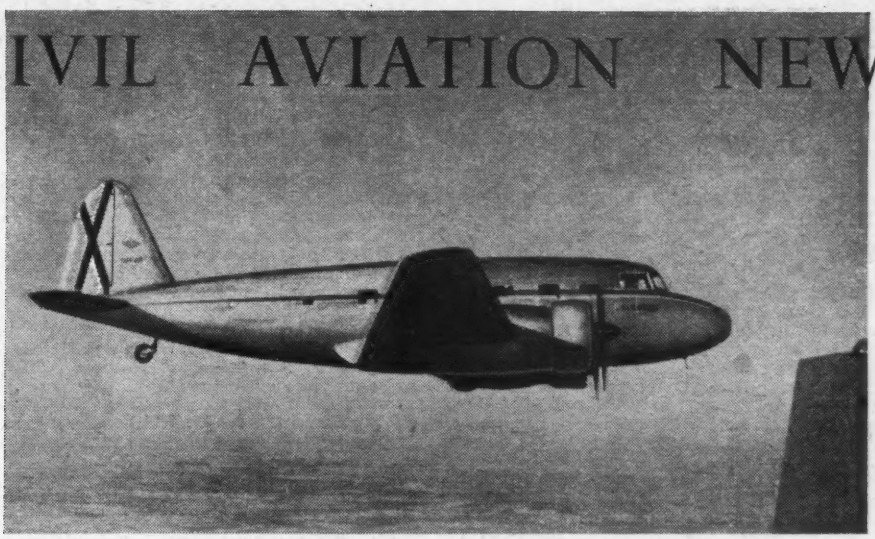




BOEING SNOWSCAPES

FROM these two seasonable studies it is evident that the Boeing aircraft company, situated in the state of Washington, has fortunate access to some splendid natural backgrounds for pictures of its products. Set against the majestic, 14,000-ft Mount Rainier above are three B-50A long-range medium bombers (the performance of this type was discussed in last week's *Flight*). The second impression, of a B-47 Stratojet near Moses Lake, is particularly remarkable for the pleasant way in which sixty military tons of jet propulsion blend with the Christmas-card country below. Both of these Boeing types are in production for the U.S.A.F.

CIVIL AVIATION NEWS



CHEETAH-POWERED: The C.A.S.A. group in Spain has developed the Type 201 Alcotan, as a feederliner and crew trainer. The prototype, seen above, has two Armstrong Siddeley Cheetah 27 engines, but production versions will have the Elizalde Sirio S-VII-A.

LONDON LANDING FEES

THE relatively high charges made in respect of landing fees at London Airport were recently the subject of discussion by the M.C.A. Committee on Public Accounts. It was stated that a Constellation on a transatlantic crossing would have to pay £20 12s 6d for landing at London Airport as compared with fees of £12 14s 9d at Brussels, £8 1s at Amsterdam, and only £4 12s at Paris.

Sir Arnold Overton, Permanent Secretary to the M.C.A., said that the higher costs were partly due to the geographical and climatic position of the airport and, in reply to a question, intimated that the complex organization for fog control was in some measure responsible for the high fees. He considered, also, that London did provide more facilities than most Continental airports, though he admitted that "the reason for our higher fees has nothing to do with cost—the traffic has been judged to be able to bear somewhat higher fees than those which the other countries have imposed. The Ministry does not think that lowering such charges will attract more foreign airlines to London." It was also revealed that I.C.A.O. was considering the possibility of reaching an agreement both with regard to facilities and ground charges.

AMERICAN OPTIMISM

A SUGGESTION that Britain's present lead in jet-transport development may not affect United States aircraft manufacturers as seriously as was first thought likely has been made by Mr. Wellwood E. Beall, a vice-president of the Boeing Corporation in a letter to airline and Government officials. He points out that Britain is now committed to a course of action on specific jet-transport types, and thinks that this fact has placed the American aircraft industry "in a firm position to better the foreign types of aircraft in every respect." He does not, however, make any reference to the current lack of any American turbojets which satisfy civil operating requirements.

Mr. Beall stated that his company is interested in developing a superior jet-transport design, and reiterates the fact that lack of available funds is, at present, the main problem. In his opinion the project must be carried through regardless of the source from which funds be forthcoming, if the U.S. is to maintain its role in aviation progress.

Such opinion is typical of the "second wind" which the American aircraft industry is now finding after the initial jolt it sustained as a result of the Farnborough revelations last September. It prompts the thought that, while the constructors of Britain's new jet airliners richly deserve their laurels, they would be wise to regard them as being of the spikier variety which prohibit restfulness: most close observers will acknowledge that, if American industry is really enabled to take up the challenge, a fast closing speed may be seen in the ensuing race.

STRATOCRUISER FLAGSHIP

NAMED *Caledonia*, the flagship of B.O.A.C.'s new Boeing-377 Stratocruiser fleet arrived at London Airport last Friday from the Boeing factory at Seattle. Although it is the third of the Stratocruisers to reach the United Kingdom, G-AKGH is the first of those specifically ordered by B.O.A.C., both *Cathay* and *Champion* having been re-directed from the original order placed by the Scandinavian Airlines System. There is, however, little difference in the aircraft themselves and the ten Stratocruisers can be regarded as integral parts of a composite fleet.

Caledonia's crossing of the Atlantic was made at a height of some 25,000ft, and flying times were: New York to Shannon, 8 hr 45 min; Shannon-London, 1 hr 20 min. The pilot was Capt. Alan Andrew. Among those who greeted the Stratocruiser at London Airport was Capt. A. S. Wilcockson, O.B.E., B.O.A.C.'s operations controller, who commanded the original "C" class flying-boat after which *Caledonia* was named, and in which Great Britain's first east-to-west Atlantic crossing was made in 1937.

It is expected that B.O.A.C. will take delivery of two more Stratocruisers before Christmas, and that the order will be completed by the spring of 1950. As mentioned in last week's *Flight*, the Stratocruiser service between London and New York will commence on December 6th, and frequencies will be progressively increased until daily services are achieved in March.

The flights will be routed through both Prestwick and Shannon, as is the practice with the Constellations currently used on this service. The delivery flights are providing valuable ground-handling practice and flight experience for aircrews.

MOBILE AIRPORT RADIO

REPRESENTATIVES from major airlines witnessed the operation, at London Airport on November 15th, of Marconi V.H.F. radio equipment for the control of airport personnel and vehicles. The demonstration clearly showed the saving of time and man-power and the increased efficiency made possible when radio is used for passing instructions from headquarters to ground crews, as an aid to the towing and parking of aircraft and for receiving reports from personnel who may be on the far side of the airport.

The equipment consisted of a Marconi-type H.16A 10-watt transmitter/receiver as the static installation, and the visitors were able to hear operational instructions and reports passing between the headquarters office of Pan American Airways, an engineer on the runway wearing a walkie-talkie set, and a tractor fitted with a Marconi H.18 two-watt transmitter/receiver. Pan American Airways have adopted Marconi V.H.F. radio for use at London Airport and H.18 equipment is now in regular use there.

CIVIL AVIATION NEWS . . .

B.E.A.'s RECOVERY

Current Economy Measures : Results Already Apparent

WHILE progress in itself is no guarantee of the ultimate success of any large-scale undertaking, the gratifying achievements of British European Airways in the last three months have caused speculation as to the nearness of the day when the Corporation may be regarded as a profit-making airline

Messages of congratulation on past achievements and encouragement for increased future efforts on the part of the staff appear in the current issue of B.E.A.'s house-journal. Lord Douglas, the chairman, says that "the substantial profit recorded for the three months July, August and September reflected the greatest credit on all employees of the Corporation, many of whom had worked themselves to a standstill during the past summer." His message continues, "Unfortunately this does not mean that B.E.A. will operate at a profit over the whole of this financial year. We still have the bad months before us, but it is a great step forward in the direction of turning B.E.A. into a profitable airline. This, of course, must be the object of all of us and I see no reason why, if we all put our backs into it, this object should not be attained within the next year or two. Stringent economy and hard work must be our watchword."

A review of progress is given by Mr. Peter Masefield, chief executive, who points out that B.E.A.'s deficit of £2,763,085 (£810,904 lower than the previous year) was recorded over a period when the Corporation was doing 33 per cent more flying. Preliminary figures for the first six months of the financial year 1949/50—from April 1st to September 30th— show further encouraging progress; and for the 12 months ended September 30th, B.E.A. reduced its deficit from nearly £2.8 million to less than £1.8 million, a deficit of 4s 6d per £ expenditure compared with 6s 9d in 1948-49. The most significant point is the fact that productivity has risen by 55 per cent.

Results of Devaluation

The effect of devaluation on B.E.A.'s operating costs and ultimate financial results is estimated to mean an increase of £450,000 in operating costs, including a figure of £183,000 which will be added to the present fuel bill of £900,000 a year as a result of the increased cost of aviation fuel. Stations in Switzerland, France, Turkey and Italy will also incur increased expenditure, so the importance of the drive for dollar traffic is emphasized. In the past 12 months the dollar income has exceeded dollar expenditure by more than $500,000, and the recent booking of 1,250 seats for American passengers on the Paris service for four days during next spring is considered to be a fine effort, meaning, as it did, an increase of some $27,875 in the form of an "invisible export."

Lord Douglas, however, has since stated that it is hoped to offset to some extent the effects of devaluation by the increased traffic which may be expected if fares are maintained at their present level despite opposition from non-devalued countries; he points out that it is essential to provide fares which can compare favourably with the rates for surface transport.

COMPARATIVE B.E.A. OPERATING STATISTICS FOR SEPTEMBER 1948 AND 1949

	U.K. Services 1948	U.K. Services 1949	Continental Services 1948	Continental Services 1949
Passenger stage flights completed	5,158	4,824	1,662	2,588
Distance flown (km) ...	933,939	898,731	1,170,747	1,584,109
" " (miles) ...	580,323	558,446	727,468	984,319
Revenue Passengers ...	50,241	53,649	25,622	37,135
Revenue Passengers (km)	12,116,146	14,607,726	18,706,922	25,018,340
" " (miles)	7,528,622	9,076,817	11,623,939	15,545,671
Excess baggage (kg) ...	42,179	47,874	65,803	73,659
" " (lb) ...	92,989	105,544	145,071	162,390
Mail (kg)	100,913	105,670	141,092	184,511
" (lb)	222,475	232,962	311,055	406,777
Freight (kg)	69,980	136,534	320,509	318,468
" (lb)	154,280	301,006	706,601	702,102
Route Distance (km) ...	3,191	4,677	17,704	16,654
" " (miles) ...	1,983	2,904	11,001	10,338

Reviewing the proposed move to London Airport in 1951, Mr. Masefield details the advantages which will result from the increased capacity and the improved maintenance facilities of London Airport in its developed form, and says that B.E.A.'s new Ambassadors and Viscounts (the first Ambassador is due for delivery on January 15th, 1950) would not fit into the present hangars at Northolt. He also stresses the further advantages of the closer connections which will be provided between B.E.A. and the long-range airlines operating from London Airport. Increased revenue and lower operating costs can be expected when the move is completed. B.E.A. has also approached the M.C.A. on the subject of improvement of facilities at Gatwick with a view to making this an adequate diversionary airport if London Airport should become too congested, particularly when peak summer traffic occurs on days of minimum visibility.

Operations with four Ambassadors will, it is hoped, be started by May, 1951. Viscounts are expected to be put into service during 1953, and the entire move to London Airport should be completed by the spring of 1954. The combination of Ambassadors (flying on the shorter routes) and Viscounts (for the longer distances) will, it is thought, give an ideally balanced fleet from an operational point of view.

As part of the stringent economy programme which the Corporation is now following, a budget control system has been introduced whereby each department and station must submit estimates of expenditure and income for the year ahead, and the results are checked each month. A clear indication of the financial progress, productivity and operating efficiency of each department can be obtained from a system of simple charts which show graphically any excesses over budget expenditure or falling-off in productivity so that remedial action can be taken immediately. An important feature of the charts is that certain figures have been calculated as a moving annual total, thereby enabling a clearer picture of the overall trend of operations to be obtained.

Three of the charts calculated on this basis are reproduced here in a simplified form and indicate effectively the progress which is being made by B.E.A.

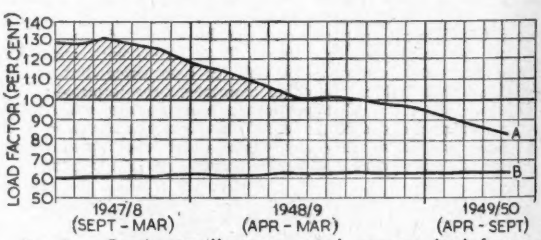


Fig. 1. "Break even" *versus* actual revenue load factors (moving annual basis).

The point of interest in Fig. 1 is that the revenue load factor has been maintained at an almost steady level of 63 per cent (representing an income of some £6,000,000; expenditure at present is £7,500,000), while capacity offered has been increased by 45 per cent during the past six months. In order to "break even" the actual revenue load factor required would, at the moment, be in the region of 80 per cent, but, by increasing capacity and reducing operating costs, it is estimated that the "break even" load factor may be reduced to 68 per cent. A budgeted revenue figure of £7,000,000 is the aim by the end of the year.

The decreased cost per capacity ton-kilometre (from 60 to 30 pence over a period of 21 months), shown in Fig. 2, is

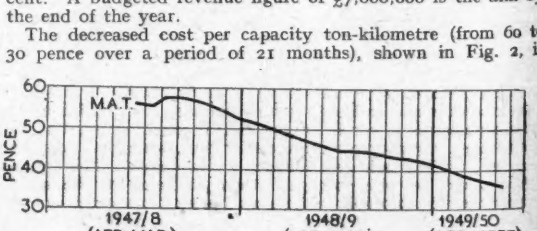


Fig. 2. Total cost per capacity ton-kilomet[illegible].

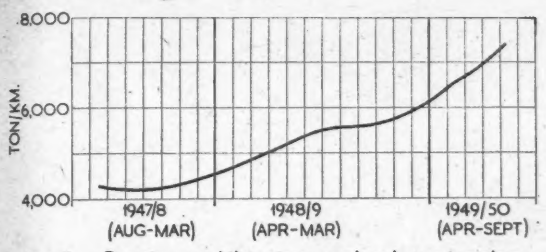


Fig. 3. Capacity ton-kilometres produced per employee (moving annual basis).

an indication of increased efficiency. It is emphasized that the cost is calculated on a moving annual total which does not relate to any individual month and takes into account all overhead expenditure.

Fig. 3 shows that productivity—measured in capacity ton/kilometres produced per employee (again on a moving annual basis)—has increased by 55 per cent during the past six months. Staff has now been reduced to a stable minimum, and the aim is to increase capacity while maintaining this fixed level of employment.

In a recent explanation of the significance of the charts Mr. Masefield stressed the fact that B.E.A.'s deficit was now decreasing more rapidly and that, while a check in this rate was to be expected as a result of immediate increased costs, a large revenue drive was currently being made, and it was hoped to reduce the deficit to a moving annual total of £1,500,000 at the end of the year.

A comparison of results for the month of September in 1948 and 1949 can be obtained from the table below. Judging by the trend which they show, it would appear that B.E.A. has adopted a policy which, assuming there to be no unforeseen set-backs, should considerably hasten the day when a complete year "in the black" can be reported

K.L.M. REPORT

IN a recently published survey of its 1948 operations K.L.M. expresses some satisfaction at the progress made during the year: that the actual amount of profit was not larger is attributed to political changes and increases in international price-levels. In some countries, says the report, the cost of fuel has risen by 30 per cent, while the price of aircraft has also reached unprecedented levels. In spite of such adverse factors modern equipment was progressively introduced during the year under review, while turnover in general was improved.

The failure of I.C.A.O. to reach a multilateral air agreement has led many countries to display an increasingly restrictive policy with an eye to the interest of their own national airlines, but (says the survey) Holland is maintaining her endeavours to secure international acceptance of a policy of freedom for air traffic.

During 1948 K.L.M. developed a new organization structure with very satisfactory results. Operating statistics of major interest are shown in the table on this page. The frequency of the New York service increased from three tc seven flights each week and a twice-weekly South American service was maintained throughout the year, while in the West Indies there was a considerable increase in traffic despite growing competition. Netherlands domestic services were withdrawn after the first six months due to improvements in road and rail transport facilities, but otherwise a considerable expansion was seen in the activities of the European Division. Most of the twelve Convairs for use in Europe were delivered during the year.

The introduction of DC-6s on the South African service enabled frequencies to be increased to three flights a week. The Amsterdam-Batavia route, however, was beset by innumerable difficulties of a technical and political nature, culminating in its suspension at the end of the year due to the troubles in Indonesia. Constellations had been gradually introduced on this route and a peak frequency of eight flights per week was attained in April of 1948. In the Batavia Inter-Island Division, operated by K.L.M. for the Government, scheduled flights were made to a total of 33 different places and increasing use was made of Catalina amphibians. At the end of the year under review some 14,000 personnel were employed (including 3,500 in Indonesia) as compared with 10,195 at the beginning of the year.

The annual survey of this well-balanced and consistently successful airline closes with an acknowledgement of the "extremely valuable support" of the Netherlands Government, with the aid of which, it is hoped, plans for 1949 and thereafter will come to fruition. Such allusions in the survey, and the apparently steady progress in the K.L.M. economy, suggest that here is one instance in which relations between State and airline operator leave little to be desired.

K.L.M. OPERATING STATISTICS

Traffic Division	Distance (km)	Revenue Passengers	Freight (kg)	Mail (kg)
N. Atlantic	5,805,057	21,207	779,154	102,166
S. Atlantic	2,518,459	9,098	103,467	17,071
West Indies	4,242,050	119,387	1,796,976	158,737
Netherlands	957,013	80,844	409,348	32,088
European	7,529,772	162,735	2,572,485	676,727
African	2,074,053	6,890	91,371	15,499
Spec. flights	934,426	4,888	369,492	3,609
Eastern/Australasian ...	10,055,289	33,533	469,712	718,853
Training, test, photography	2,624,815	—	—	—
Totals	36,803,934	438,582	6,502,005	1,724,750

BREVITIES

IT is understood that one of the world's largest airfields is to be built at Ankara. Named after Asemboa, one of Tamburlaine's generals, it will occupy part of the site of the great 14th-century battle between the Tartar conqueror and the Sultan Bajazet. The runway will be 200ft wide and 1½ miles long.

* * *

Replying to a question in the House of Commons, Mr. Lindgren, Parliamentary Secretary to the M.C.A., stated that 100 flying clubs were now functioning in Great Britain, of which 30 operated from privately owned airfields, 13 from airfields used by scheduled air services, nine from airfields used by the R.Aux.A.F. and nine from airfields used jointly by the R.Aux.A.F. and scheduled air services.

* * *

A private pilot was fined £25 at Staple Hill (Gloucestershire) Petty Sessions on November 10th for infringing the special conditions of the Air Navigation Regulations, 1949, which prohibit aircraft flying below 5,000ft within a three-nautical-mile radius of Filton Airfield (unless in R/T contact or cleared by A.T.C. Filton) while Brabazon flight trials are in progress

* * *

The first flight of a weekly B.O.A.C. London-Colombo service which will connect with the London-Singapore route left London on November 16th. Elapsed time for the flight from London to Singapore is now 49 hours, including a two-hour stop at Colombo; the return flight can be made in 60 hours, including a night stop at Colombo. Argonauts are used on both sections of the route.

* * *

The new London headquarters of International Aeradio, Ltd., are due to open on November 28th and not, as inadvertently stated last week, at an earlier date. The address is Aeradio House, 40, Park Street, London, W.1.

* * *

Shoreham Airport is no longer scheduled for nationalization and the M.C.A. has informed Brighton, Hove and Worthing Corporations that the airport, which they operated before the war as a joint municipal enterprise, is to be derequisitioned. It is understood that Brighton Council are considering a proposal that the airport should be leased. While requisitioned by the M.C.A. the airport has been costing the three authorities £1,375 a year.

* * *

An expansion of the scheme providing cheap air travel for students and schoolchildren returning to their homes on holiday has been announced by Air France. The new return fares will be 50 per cent of the normal adult fare for all destinations in Europe, Africa, Asia and Australia. Reduc-

CIVIL AVIATION NEWS

tions of 35 per cent are also being made on fares to North and South America. The main conditions are that parents must live in a different country from that in which the school is situated and that journeys are not to be broken.

* * *

The delivery of *Arion*, the last of the fleet of 22 Canadian-built Argonauts for B.O.A.C.—it arrived at London Airport on November 11th—marked the completion of the order eight months ahead of contract date. Argonauts are already in operation on the U.K. to Middle East and U.K. to Hong Kong and Tokyo routes and are being introduced progressively on services to the Persian Gulf, Israel, Pakistan, India, Ceylon and Malaya this month.

* * *

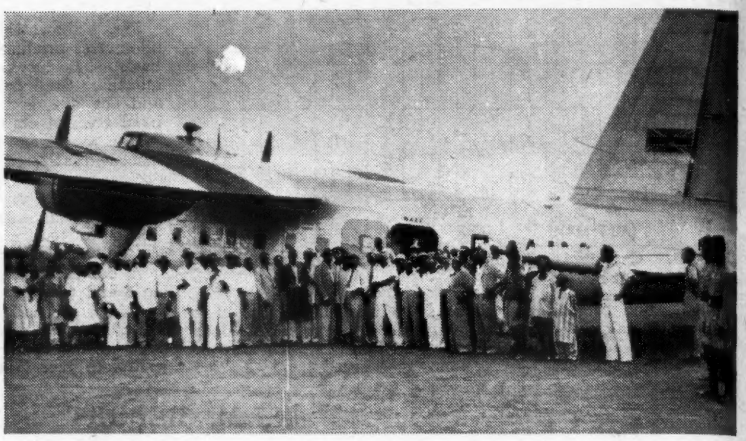
The Parliamentary Secretary to the M.C.A., Mr. Lindgren, recently stated in the House of Commons that the report on the enquiry into the accident to the K.L.M. Constellation at Prestwick a year ago would shortly be published. He denied that the report, containing certain criticism of Prestwick, had been published in Holland a month before; it would he said, be published simultaneously by the two Governments.

* * *

Mr. Daniel Ecker, former secretary for aviation to the New York Board of Trade, has been appointed head of an air transport advisory bureau to be established by the Commerce and Industry Association in New York. The purpose of the bureau will be to protect the interests of members of the association in all matters relating to air transport.

* * *

Inauguration of an "air coach" service between Chicago and Miami, with fares as low as 4 cents (about 3½d) per mile, has been announced by Delta Air Lines. The service, on which Skymasters will be used, is scheduled to commence on December 16th and will serve such intermediate points as Cincinnati, Atlanta and Jacksonville.



PUNTERS' PULLMAN: Evidence of the enthusiasm with which West Africans have greeted the advent of air transport is provided by this photograph of the passengers of a "Race Special" operated by West African Airways Corporation between Lagos and Ibadan. Normally used as troop-transports, the 56-seat Bristol Freighters have been put into service as second-class airliners, enabling reduced fares to be charged.

Two Chinese airline companies controlled by the Nationalist Government found their fleets considerably depleted when, recently, ten Curtiss Commandos belonging to the China National Aviation Corporation, together with a Commando and a new Convair of Central Air Transport Corporation, took off from Hong Kong and joined the Communist forces in Shanghai and Peking.

* * *

Under winter schedules which came into operation on November 1st, B.O.A.C. Solents flying between Southampton and Johannesburg leave Southampton at 0815 hr (instead of at 1130 hr) on Tuesdays, Wednesdays and Fridays. Return services reach Southampton about an hour earlier. Solent services to Nairobi have been increased to four a week, while the service to Dar-es-Salaam has been withdrawn. East African Airways operate connections between Nairobi and Dar-es-Salaam.

FROM THE CLUBS

NOW added to the clubs whose training programmes have been approved by the Ministry of Civil Aviation is the Northamptonshire Aero Club at Sywell. Two Private Pilot's Licences were obtained during October.

Adverse weather caused the cancellation of a lunch-patrol attack on the Wolverhampton Club, but the "fireworks and tramps" party on November 5th was a great success; Mr. R. H. Parsons carried off the Chairman's prize for the "best-turned-out tramp."

* * *

AMONG pupils at the Wiltshire School of Flying are six officers from Glub Pasha's Arab Legion; their Private Pilot's Licence training will be completed within the next few weeks. Flying time during the last three months has been maintained at a high level. During August 235 hours were recorded, in September 164 hours and in October 203 hours, bringing the total for the last nine months to 1,898 hours.

* * *

LAST week three members of the South Coast Flying Club achieved their first solos after very little dual: a new post-war record for the Club was set up by Mr. Peter Cellier, who soloed after 5½ hours, but he was closely challenged by Mr. Harry Crundwell (6 hours) and by Mr. W. Van Tromp (6½ hours). At a dance held on November 12th these three members presented their instructor, Mr. C. L. Pashley, with a suitably inscribed pewter tankard.

* * *

MEMBERSHIP of the Luton Flying Club (now under new management) is steadily growing. It now totals 120, and it is anticipated that with the present enthusiastic support the existing fleet of two Austers will have to be augmented by the summer. The flying training facilities were recently inspected by the M.C.A., and it is hoped that official approval for the 30-hour course will shortly be received; at present 15 members are under tuition. Flying hours numbered 76 in September and approximately 50 during October. A Christmas party and dance is being held on December 17th, but the major social event of the season will be held to celebrate the opening of the new clubhouse early in the New Year.

REFRESHER COURSE: Mr. M. E. Holroyd of Leamington Spa learned to fly at Hendon in 1917 and flew for a year. Now, 33 years later, he has qualified for his Student Pilot's Licence under the tuition of Mr. Roy Bradley, test pilot of Helliwells, Ltd., at Walsall. In the words of the newspaper reader, "Is this a record?"

HOLLAND'S JET TRAINER

Preliminary Details of an Unconventional Fokker Project

A suitably sturdy appearance with the promise of lively performance are revealed in this impression of the S.14.

IT frequently happens that the appearance of any new and unorthodox British or American military aircraft is sooner or later followed by a more or less similar counterpart on the Continent—differing in equipment, perhaps, but built to the same general specification and sometimes bearing a marked resemblance to the original.

A particularly interesting and promising exception is a new Fokker, the S.14, which is being produced to a unique specification — that of a turbojet-powered advanced trainer, offering side-by-side seating of pupil and instructor, simplicity in maintenance and construction and an adequate all-round performance. Compliance with this essential requirement of robust simplicity is evident in impressions of the S.14 published by the makers, showing both detail construction and general outline.

The Fokker works can have had little hesitation in selecting the Rolls-Royce Derwent 5 (3,500 lb s.t.) as the S.14's power unit. Backed by thousands of successful flying hours, the same turbojet powers the standard intercepter of the Royal Netherlands Air Force—the Gloster Meteor 4. Fokker, it is reported, are to build several hundred Meteor 8s for both Holland and Belgium; simultaneously, Derwent 5s will be in full production at more than one Western Union factory.

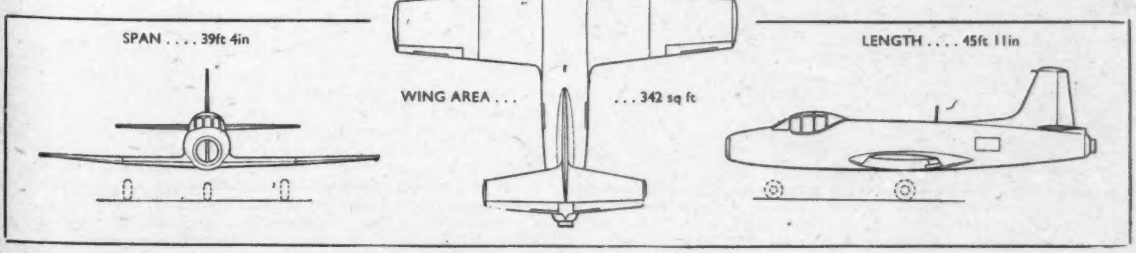
S.14 power installation is straightforward. Surrounded by steel walls, the Derwent rests in the centre of the fuselage above the low-position wing; a fireproof steel bulkhead separates it from the cockpit. Compressor air is supplied by two "straight-through" ducts which diverge sharply from a single, circular nose-intake. Fuselage construction, other than that of the engine compartment, is of light alloy.

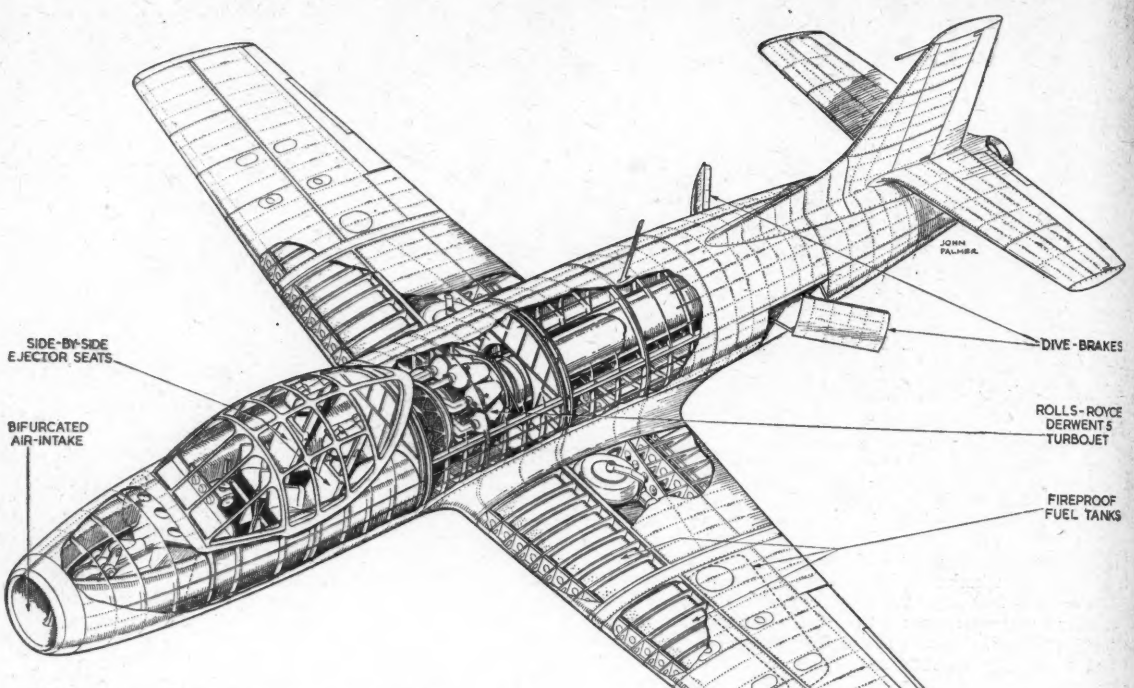
Layout of the cockpit controls and instruments are likely to follow British practice, since the original design of the S.14 was reported to have been submitted to Air Ministry training specialists for comment. For pupil and instructor, there are side-by-side ejector seats, and there is provision for a third seat behind them, in place of radio or radar equipment. Throttle and dive-brake levers are duplicated, but the remaining controls are carried on a central pedestal; oxygen installation and batteries are contained in the cockpit, and the electrical system is installed beneath the cockpit floor, being accessible through inspection panels. The sliding hood, a large, heavily framed structure, is jettisonable and is operated electrically.

On both sides of the rear fuselage are mounted pneumatically operated, door-type dive-brakes which operate simultaneously. The long jet-pipe is held on trunnions, and may be released and pushed back for inspection of the turbine.

Fireproof fuel tanks are carried in both centre and outer sections of the tapered, all-metal wing, which is Alclad-covered. Electric booster pumps transfer fuel from the inner tanks to the power unit, and air pressure delivers fuel from the outer tanks. Split trailing-edge flaps extend across the width of the centre-section and part of the outer wings. The centre-sections are bolted separately to the lower fuselage.

Tail surfaces are all-metal and form a single unit, the leading edge of the tailplane being set at the base of the single, square-cut fin-and-rudder, while the trailing edge is faired on to the fuselage tail above the jet pipe outlet. The undercarriage is operated pneumatically, and consists of lever-suspension nosewheel and main wheels with Dowty liquid-spring shock-absorbers. The main assemblies retract inwards into the centre section and the self-centring nosewheel retracts forwards into





EVIDENT in this new *Flight* drawing of the Fokker S.14 are its robust construction and straightforward power installation. The fuselage-fitted dive-brakes follow American rather than British practice.

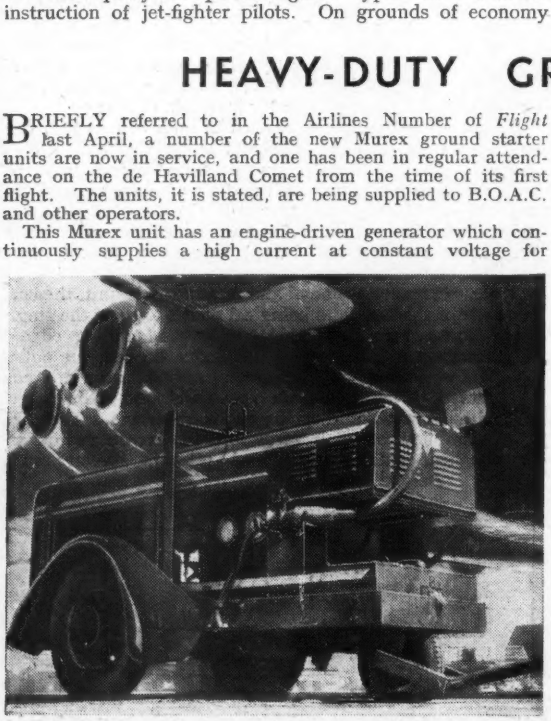
the angle formed by the bifurcated air-intake ducts.

Succesful adaptation and application of British and American jet fighters as two-seat trainers has demonstrated the inadequacy of piston-engined types for advanced instruction of jet-fighter pilots. On grounds of economy alone, an obvious next step is the design of an aircraft specifically for this duty. Fokker's S.14 is the first machine in such a category, and its progress will therefore be watched with interest.

HEAVY-DUTY GROUND STARTING

BRIEFLY referred to in the Airlines Number of *Flight* last April, a number of the new Murex ground starter units are now in service, and one has been in regular attendance on the de Havilland Comet from the time of its first flight. The units, it is stated, are being supplied to B.O.A.C. and other operators.

This Murex unit has an engine-driven generator which continuously supplies a high current at constant voltage for servicing and pre-flight checks and a very high peak current for starting both reciprocating and gas-turbine power units.



A Murex unit positioned for starting the D.H. Comet.

Recently a test was made on a Boeing Stratocruiser at London Airport. As the electrical requirements of this aircraft were known to be heavy, two Murex units were first coupled in parallel. After a routine pre-flight check had been made and the engines started by the units, it was found that one unit had ample capacity to provide the current required. The test was witnessed by representatives of the Ministry of Supply, B.O.A.C. and Pan-American Airways.

The standard Murex unit operates at 28.5v and supplies a current of 600 amp continuously for servicing and pre-flight checks and a peak starting current of approximately 1,200 amp for engine starting periods. Other units are built to operate at 125v and in various capacities. The unit is mounted on a low trailer which enables it to pass under the wings and fuselages of all large aircraft.

Murex Welding Processes, Ltd., Waltham Cross, Herts, are the makers.

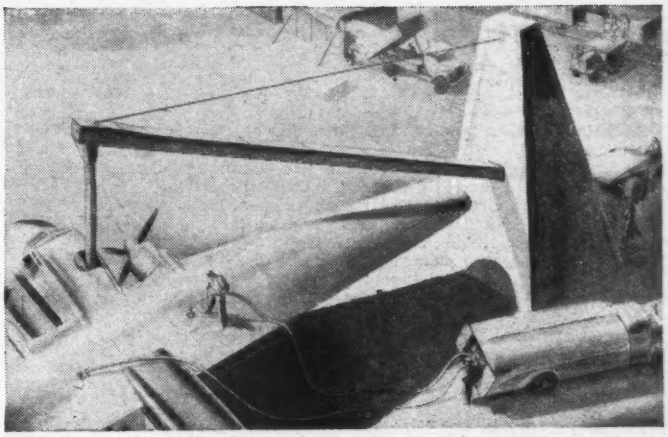
PICTURE BOOK

"Airliners." Written and drawn by John Stroud. Puffin Picture Book 86. Penguin Books, Ltd., 1s 6d.

THE diligence of Mr. Stroud in ensuring the authenticity of his drawings and descriptions is no less in degree than his artistic talent; so this latest Puffin book, we believe, will prove equally satisfying to the student of air commerce and the connoisseur of aeronautical art. The cleanness and simplicity of Mr. Stroud's pencil and brush work are exemplary; yet he contrives to present the character of an aircraft even in his least pretentious sketches. The companion paintings of the Supermarine Sea Eagle amphibian and D.H.34 and that of a waterborne Ju52 floatplane are, to our mind, the pick of this delightfully presented gallery of transport aircraft.

FREIGHTER-FERTILIZER

Suggested Employment of the Bristol 170 for Phosphate-distribution



Proposed conveyor-belt method of loading a Freighter with phosphate. For maximum utilization, the operation would take place simultaneously with refuelling.

GRADUALLY and unobtrusively, perhaps because of the prosaic nature of their occupation, extremely large numbers of aircraft have in recent years been adopted for "utility" duties. Agriculture has been the major beneficiary, as testified by the announcement that no fewer than 8,000 aircraft are now employed in the United States for seeding, crop-protection and similar functions.

Over twelve months ago, the Royal New Zealand Air Force, employing Grumman Avengers, began a series of experiments to assess the efficacy of aerial "top-dressing"—the distribution of phosphate fertilizer—in hilly, inaccessible territories. Considerable success was achieved, and a mass of operating data accumulated as a springboard from which to tackle the work of full-scale fertilization and conservation of soil from erosion; this is a project which will cover enormous areas of land, and, it is hoped, increase New Zealand's agricultural production by several million pounds.

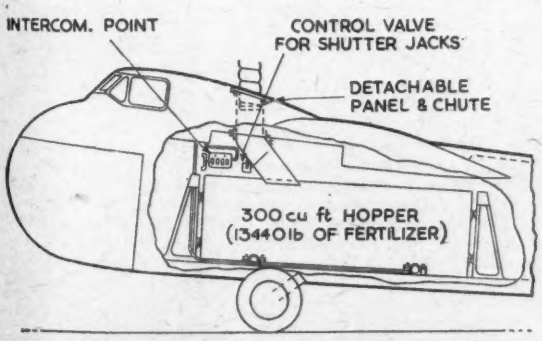
Largely on the basis of the R.N.Z.A.F. findings, the Bristol Aeroplane Company has made a detailed preliminary study of this work in relation to the potentialities of the Bristol Freighter. As a fully developed, well-proven design, the Freighter is an obvious candidate; light aircraft, it is thought, will be able to do little more than scratch the surface of the enormous task. For quick and economic operation, the phosphate-distributing aircraft must be capable of being fully loaded with fertilizer while refuelling is taking place, and must be readily convertible for other duties; additional requirements are low initial and operating costs, ease of maintenance, safe slow-flying characteristics at low altitude, and the ability to fly from restricted and unimproved airfields.

The Bristol suggestions, therefore, envisage use of the Military Type 170 fitted with an internal, removable, canvas hopper of six tons capacity, embodying integral equipment for agitating and distributing its contents. Loading time would be in the region of ten minutes, and removal of the hopper would be facilitated by the Freighter's nose doors.

Utilization, it is claimed, would consequently be considerably greater than that afforded by a majority of more expensive, four-engined aircraft, since the latter would probably require structural alteration to enable an adequate load to be carried internally. A sufficiently large externally slung hopper might prove difficult to handle on the ground and would also constitute an aerodynamic problem. Both methods might preclude quick conversion for a military transport role. The possibility that the R.N.Z.A.F. might be the only organization large enough to handle the top-dressing project emphasizes the need for a machine with transport capabilities.

Apart from the phosphate-container, the only other important modifications to the Freighter would be the provision of a strengthened floor, incorporating a distribution aperture (variable according to the size of the required swathe of fertilizer), a loading duct in the top of the fuselage, and an intercom system between pilot and hopper-operator.

The problem of quick and simple loading has occupied considerable thought on the part of the Bristol Company, and one of their suggestions (illustrated above), calls for the erection, near sources of bulk supply, of ground hoppers from which phosphate could be fed to the aircraft by conveyer belt *via* a cantilever or jib structure terminating in a flexible hose and funnel, the final transfer being made by gravity.



Interior layout of the Freighter's fuselage, fitted with a hopper of 13,440 lb capacity. The disposition of the integral agitator and distributor is also shown.

Cost Estimates

On the basis of assumed agricultural and operational requirements, the Company has made detailed estimates of utilization and performance. It was assumed, for example, that a 50-mile radius of action between airfield and operating-area would be required in treatment of the 750,000 acres estimated to be the immediate annual target. Resulting calculations show that the aircraft engaged could make a complete sortie in 1 hr 30 min, time being allowed for refuelling, reloading and pilot briefing. Assuming, therefore, the completion of seven sorties, a Freighter could treat 420 acres per flying day. If the weather in New Zealand hill country permitted operation on about 120 days of the year, a fleet of 15 Freighters, each flying 840 hr per year, would be required to accomplish the immediate objective, assuming an actual flying time of 1 hr per sortie.

Since these estimates were made, however, it has been learned that flying would be possible on about 200 days of the year, with a consequent increase in Freighter utilization. The annual target might in fact be considerably greater than 750,000 acres, and other assumptions have also proved to be conservative. The figures quoted above, therefore, are intended only to provide a working basis and do not in themselves constitute a plan.

Direct operating costs, allowing for deprecation of aircraft and equipment, but exclusive of the cost of phosphate and ancillary ground equipment, would be approximately 14s per acre. Should the Defence Budget cover the expenses of both capital outlay and maintenance of the aircraft, or of initial cost alone, the approximate cost per acre would be reduced to, respectively, 4s 10d or 8s 6d.

Bristol's interest, it should be stressed, lies solely in the supply of suitably equipped aircraft, and methods of operating, loading, etc., are the responsibility of the New Zealand authorities. Nevertheless, the company's comprehensive study of the subject has met with considerable interest in New Zealand, and its proposals, in substance, are thought to be sound. On-the-spot information compiled recently by Bristol representatives is being incorporated in the final design of phosphate-distribution equipment now being developed for the Freighter, which is likely to be the subject of further negotiations with the New Zealand Government. Major decisions have yet to be taken, but the prospects are broad and intriguing, in that they suggest one of the first occasions of systematic operation of a fleet of large utility aircraft on a national scale.

TWO NOTABLE BOOKS

A Polish Odyssey and the Story of A.A. Command

THE story of *Destiny Can Wait** is of an Odyssey that has never ended. It tells how hundreds of Polish aircrew, refusing to accept the defeat of their own country, endured great hardships to reach England and carry on the fight. It tells also how the victory for which four-fifths of them subsequently died brought no freedom to Poland, so that the survivors found the road home closed for ever.

This book is both a memorial to those who died and a means of helping their dependents and colleagues, for its profits go to the Polish Air Force Association. Nevertheless, *Destiny Can Wait* can sell on its merits, for it is a well-compiled, deeply moving story based on combat reports, squadron diaries and the personal narratives of the airmen themselves. It is illustrated by scores of excellent photographs, and by drawings by Feliks Topolski.

Marshal of the Royal Air Force Viscount Portal writes in his foreword: "The Poles brought to the common cause a fierce and uncompromising opposition to the Nazis and all they stood for. It was through the gallant and timely contribution of [their] fighter pilots to victory in the Battle of Britain that the Polish Air Force made its name with the British people and indeed with the whole free world. But Polish airmen served in every other home Command of the Royal Air Force, and the quality of their service on operations emerges from this book: in sum it was the biggest effort of any of the Allied air forces which served under R.A.F. control."

Almost every page of *Destiny Can Wait* contains some story of heroism and endurance, without ever a hint of line-shooting. Nor is there any tearful obituary for those who did not return; instead, one reads (for example): "Lt. B. reported for third operational tour. Killed on 53rd sortie. Was a good comrade." As an afterthought, the writer adds "If his efforts in the service are totted up, it will be found he destroyed the equivalent of at least a medium-sized German town."

Destiny Can Wait is a book which deserves a place in every R.A.F. station library, for these men were part of the Royal Air Force, and their achievements form part of the fine tradition of the Service. It is, in a sense, the second volume of a complete history of the Polish Air Force from 1918 to 1946, for its early history was described in a book published before the war. There is no Polish airman who believes that this is the end of the story.

" Destiny Can Wait—The History of the Polish Air Force in Great Britain." William Heinemann, Ltd., 25s net. Obtainable from The Polish Air Force Association, 14, Collingham Gardens, London, S.W.5.

Friendly Flak

NOBODY is better qualified to tell the story of Anti-Aircraft Command* than Sir Frederick Pile, for he was its C.-in-C. during the whole of the war. He writes with pride of the fine achievements of his gunners and searchlight crews, and with occasional bitterness of the way they were treated by officialdom. He answers many questions that puzzled civilians in wartime, such as why the guns and lights were sometimes inactive while enemy bombers were overhead; or why, in the early days of the flying-bomb attack, Air Ministry communiques never admitted that the guns had destroyed even a single V.1.

Of particular interest is Sir Frederick's claim that Anti-Aircraft Command would probably have been able to blow up 10 per cent of the V.2 rockets, by means of radio proximity-fuse shells, had the war continued.

There is humour, too, in *Ack-Ack*, especially when Sir Frederick describes some of the "inventions" submitted for his approval. For example, one new weapon, reminiscent of a certain fabulous bird, was shaped "like a propeller that flew in ever-decreasing circles until the target flew into it."

The troops of Anti-Aircraft Command were the first in the country to go into action; they remained on the alert during the whole 5½ years of war. As well as 1,972 flying-bombs, they destroyed 822 enemy aircraft, probably destroyed 237 more and damaged 422.

"And," drily comments Sir Frederick, "at the height of their triumph, the labourers received their reward. . . . A.A. Command was allowed to share with any civilian who had endured three months of fire-watching the Defence Medal, with its 'two black stripes representing the black-out.'"

J. W. R. T.

" ACK-ACK—Britain's Defence against Air Attack during the Second World War," by General Sir Frederick Pile. George G. Harrap, 18s net.

COOLER CABINS

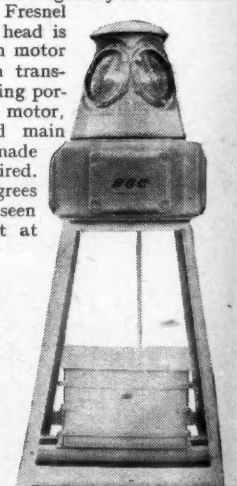
THE high cabin temperatures which result from aircraft standing in the intense heat of the mid-day sun constituted a major problem for Central African Airways: passengers constantly complained of the extreme discomfort despite the fact that the cabins of the aircraft were equipped with electric fans. In their search for a remedy the company eventually came to the conclusion that the well-known heat-reflection principle exemplified in the wearing of white clothing and the painting of buildings white might profitably be used. The fuselage-tops of their Doves were therefore given a coat of white, and a big improvement at once became apparent.

A recent test with one untreated and one painted aircraft revealed that the cabin temperature of the white-topped aircraft was 15 degrees lower than that of the other aircraft. The whole C.A.A. fleet, including Vikings, is now being treated.

One of Central African Airways' white-painted doves.

HELICOPTER BEACONS

TWO new airfield location beacons have been supplied by the General Electric Co., Ltd., for the experimental mail-carrying service resumed this month by the B.E.A. Helicopter Unit. The beacons installed at Peterborough and Norwich have been produced to specifications provided by the Helicopter Unit, but are suitable for operation with ordinary aircraft and flying boats. The light-source is an Osram 2,000-watt, flat-grid-filament, bi-post projector lamp, mounted diagonally at the common focus of the four 10-in diameter Fresnel lenses in the rotating head. The head is driven at 6 r.p.m. by an induction motor from a belt and worm-and-pinion transmission. A casing below the rotating portion of the beacon contains the motor, gear box, contactors, fuses and main switch. Provision has also been made for remote operation when required. The beams are emitted at 15 degrees above the horizontal so as to be seen with maximum effect by a pilot at 1,000ft at a distance of one to two miles. The maximum range of the beacon is in the region of 20 miles, at which distance the duration of the flashes is about half a second. The beams are divergent, including an angle of 15 degrees, and maximum intensity is approximately 100,000 c.p. A stand, normally about 4ft in height, is provided for mounting the beacon, and two green and two white lenses are fitted.



The new G.E.C. Beacon.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

TRANSPORT COMMAND

THE November 9th issue of the *Daily Telegraph* contains the news that R.A.F. Transport Command may be reduced or abolished under the latest economy cuts. Apparently it has been argued in some quarters that the successes achieved by airborne forces were not in proportion to the expenditure involved.

It is, of course, true that airborne assault is expensive, but it requires no argument to prove that airborne forces are an essential part of a modern army. The other side of Transport Command, that of trooping and support and supply, not to mention backloads of wounded, is one without which a modern army would be hopelessly lost.

The abolition of Transport Command, therefore, would be an inexcusable blunder, one which might save a few coppers now at the expense of thousands of lives in any future conflict we may be involved in. A drastic reduction in the strength of our transport squadrons may, however, be advisable—provided that civil aviation in this country is given the freedom to expand to its rightful level.

Hundreds upon hundreds of highly experienced aircrews have been forced to give up flying as a career. The crippling restrictions on charter companies have made civil aviation perhaps the most insecure industry in the country. Having spent a large proportion of one's money on the necessary licences and the rest on trying to stay the course, it requires almost fanatical zeal to keep going when everything points to it being a losing battle. It is not too late—quite—to save the experience and skill which is now being lost. Strong and healthy civil aviation, apart from showing the flag and earning money and prestige in peacetime, automatically provides a large pool of the finest crews with which a small regular nucleus could be quickly reinforced to rebuild Transport Command to full fighting strength. Also, the civil transports available would be of very great value in an emergency.

A great deal of money could be saved, invaluable experience retained, and sadly lacking prestige regained by adopting the following measures:—

(a) Unshackling the charter companies.

(b) Strengthening our depleted bomber and fighter squadrons with the men now engaged on Transport duties, retaining only the smallest possible nucleus of the best crews to carry out research and development flying in all parts of the world with the latest aircraft, in order that the R.A.F. should be second to none in its ability and knowledge of the latest applications of tactical assault and support.

(c) As far as necessary and advisable, using civil aircraft to carry on essential R.A.F. services.

London, S.W.7. G. HEILIG.

CREDIT FOR INVENTIONS

LET "Designer" (see his letter in *Flight* October 20th) and his colleagues at the R.A.E., Farnborough, obtain recognition and reward for their work in initiating, designing and developing equipment for our aircraft.

Let their names be given to their inventions and the country will be richer.

Under the present procedure, inventions and proposals go through the Ministry of Supply for consideration and use, and information can be disseminated by the Ministry by word of mouth. The result is that a good number of inventions are not patented as most certainly would be the case if the companies producing the devices were the "first and true" inventors. In the case of an invention proposed to the Ministry it can and does deny inventors the right to take their cases before the Royal Commission on Awards to Inventors.

Thus inventors do not have the incentive to create, and their powers are dulled. The country in this way loses the full power of their brains, or their services, or both, besides losing the dollars and overseas currency which would result from the patenting of their inventions.

London, N.W.6. J. R. ANDERSON.

FLYING THE "NINE ACK"

THERE are, I think, a few inaccuracies in G/C. Peter Stewart's recollections of flying the D.H.9A, quoted in the history of No. 600 Squadron published in *Flight* of November 3rd.

The total fuel capacity was 108 gallons; the main tank held 100, and the gravity tank the remainder. In overseas versions the total capacity was increased a further 35 gallons by the installation of a tank on the bottom surface of the starboard top mainplane. Fuel consumption averaged 27.5 gal./hr.

Dealing with the fuel system: Fitted in the overflow pipe from gravity to main tank was a "flow indicator." When the gravity tank became full, and fuel commenced to flow through the overflow pipe into the main tank, the glass of the indicator turned "black." This indicator was directly visible to the pilot, who then turned the fuel cock to "main tank only." If this was not done, fuel continued to flow into the gravity tank until it was completely full, and was then forced out through the vent-hole in the gravity-tank filler cap; naturally, the pilot received a cloud of fuel over his head.

I cannot quite think how G/C. (then F/L.) Stewart managed to run on one battery when throttled back. The only switch I remember, with the exception of those wired for dual control, was situated centrally on the pilot's instrument panel. The left switch cut out the left distributor and the right switch the right distributor. The engine-driven generator commenced to show a charge at 600 r.p.m.

Cambridge. EX-NINE-ACK FITTER,
14 Squadron.

HELICOPTER RESCUE

ARE helicopters being put to their best possible use in this country? By "best possible use" I mean humanitarian purposes. The helicopter has not yet been developed to a stage where it can carry a reasonable amount of passengers or a profitable amount of freight, but helicopters do exist that can save lives. In fact, the helicopter, although it has not yet reached adolescence, has saved well over a hundred lives. The recent case in Cherbourg, where a life was lost merely because no suitably equipped helicopter was available for immediate rescue work, serves as a warning to this country. There must be many occasions every year when a helicopter could perform missions of mercy impossible to any other form of transport. Possible applications of helicopters as aerial "lifeboats" and aerial ambulances are well known; some of the others are impossible to predict, as witness the rescue a few months ago of someone about to drown in soft mud.

It is now time for some authority such as M.C.A. to start forming a fleet of at *least* a dozen helicopters, all of which should be equipped for rescue and ambulance work and which could be used for humanitarian tasks that are impossible to other forms of transport. There would be a central administration, and a base for carrying out major inspections. The aircraft would be distributed evenly over the country with their operating air and ground crews and would only return to the central base for major inspections. On receipt of an emergency call, the helicopter that could reach the required position in the shortest time (not necessarily the nearest aircraft) would be despatched with pilot, and crew if needed. The crew might be required for operating the hoist, helping people aboard and, until the Decca Flight Log is available, navigating by the normal Decometers.

There is the difficulty of keeping personnel in practice during "off" periods. This can be overcome and, at the same time some of the expense of the scheme offset, by making the nature of the organization very flexible. Pilots and ground crews need not necessarily be actual full-time members of this national fleet but could be borrowed from units already operating for periods of, say, a month at a time—if necessary bringing their own aircraft. This arrangement might mean that helicopter units, and here I include Service as well as civil units, must have on their books extra aircraft and crews to enable them to contribute to the common pool; if the units were reimbursed for this they need not be unduly upset. An even more elastic side of the scheme, where helicopter units are already operating in suitable geographical situations, would

CORRESPONDENCE . . .

be for the aircraft to actually operate from their parent unit but under the orders of the main base.

This national organization, like the Health Service, would be a fairly costly one. But who counts cost where the prize is the saving of human life?

At present few, if any, helicopter operators in this country could despatch at very short notice a helicopter equipped with the necessary gear for rescue work. This state of affairs should not be. Helicopters must be in a position to save lives before they start dusting crops or carrying mails. If I may be permitted to parody :—

"All the postcards ever read,
Will not pay for one man dead."

My outline is, of necessity, brief, but I should be interested in readers' comments and suggestions.

Surrey. AEOLUS.

No. 600 SQUADRON

I WAS very interested in the history of No. 600 Squadron, by John Yoxall, which appeared in the issue of *Flight* dated November 3rd. There are, however, a few errors in the account which I was able to detect.

When relating how 600 Squadron moved to its war station, Northolt, in 1939, the writer says: "As companions at Northolt they had Nos. 25 and 111 Squadrons, both equipped with Hurricanes." No. 25 Squadron, in which I was serving, had Blenheims. We had converted to them from Gladiators that year and had only narrowly beaten our Auxilliary rivals to the "operational" state.

While still on the subject of Northolt the history declares, "In November, 1939, they had the first three aircraft to carry airborne radar." This is quite incorrect although it is very complimentary to my "Security." Under a blanket of secrecy I was appointed to command a section of No. 25 Squadron. This consisted of three short-nosed Blenheims fitted with the first air-to-air airborne radar, called "A.I." I understood from the scientist working with me at the time that air-to-sea radar had already been used by another unit. My section was later re-equipped with long-nosed Blenheims and I passed on the little knowledge I had accumulated to Ralph Hiscox, who was then taking over a section of No. 600 Squadron also equipped with "A.I."

My relations with 600 then ceased until I took over "A" Flight at Rosignano in July, 1944. Rosignano is not mentioned in the history, but the squadron was there when the landing in the South of France was made. If the girls at the Follonica G.C.I. station were worthy of inclusion I cannot understand why the bathing belles of Castiglioncello have not received mention.

The chronicler then continues, "On August 25th, 1944, the 8th Army started its assault on Rimini and No. 600 left the 5th Army and moved over to Falconara." As a matter of fact only "A" Flight moved to Falconara at that time and "B" Flight remained for a while on the West coast. Both Flights scored successes and one night the C.O. (Laurie Styles) and I, flying on opposite sides of Italy, held a cryptic conversation on the R/T. which revealed that the Squadron score had topped 150. "A" Flight's party celebrating this was one of those things.

B.A.O.R. 1, Germany. P. L. BURKE.

WANTED—OLD ROTOR BLADES

WE have been informed that there are a quantity of discarded helicopter blades, 20ft or more long, collected at various airfields. We require 50 to 60 of them for air movement to control frosting in orchards; they would revolve only at a low speed.

We have communicated with all the likely Ministries and many departments but cannot get anyone to show the slightest interest. We should be most grateful if you could put us in touch with the right official because we are certain the blades are available if we could once contact the right quarter.

Boxted, Colchester, Essex. K. L. GRIFFIN, Office Manager, Carter and Blewitt, Ltd.

[We have confirmed that, in the absence of information as to the location of such stores, the disposals sections of the Ministry of Supply are unable to assist. Perhaps readers may be able to help.—ED.]

R.Ae.C. Aviators' Certificates

AVIATORS' certificates have been awarded by the R.Ae.C. to the pilots named below, the list covering the period from August 8th to September 20th, 1949. The previous list (July 4th to August 5th) was published in *Flight* of September 29th.

No.	Name	Club or School	Date
26,089	Roy William Stephens ...	Herts & Essex Aero Club	5.8.49
26,090	Spencer Ramsey Kendal ...	Qualified Service pilot	5.8.49
26,091	Norman Devonport	Wolverhampton Aero Club	8.8.49
26,092	Anthony William Fishley Maylett	Qualified Service pilot	8.8.49
26,093	Raymond William Bray ...	No. 7 F.T.S.	9.8.49
26,094	Hugh Thomas Elliott	Qualified Service pilot	10.8.49
26,095	Philip George Gladstone ...	Qualified Service pilot...	10.8.49
26,096	Peter Stead	Qualified Service pilot...	10.8.49
26,097	Robert Hubert Elkington ...	Nottingham Flying Club	15.8.49
26,098	Herbert Howell Edwards ...	Qualified Service pilot...	15.8.49
26,099	Alan Edward Marriott ...	Qualified Service pilot...	16.8.49
26,100	Colin Douglas Street	Wiltshire School of Flying	16.8.49
26,101	William Hendel Upperton ...	Qualified Service pilot...	16.8.49
26,102	Jacques Spencer Chapman ...	Kent Coast Flying Club	17.8.49
26,104	Rex Edward Durrant Pain ...	Midland Bank Flying Club	17.8.49
26,103	Keith Gordon Brown	Midland Bank Flying Club	17.8.49
26,105	William Denis Delany	Qualified Service pilot...	18.8.49
26,106	John Frederick Tayler	Southend Flying School	18.8.49
26,107	Harry Geoffrey Kay	Blackpool and Fylde A.C.	18.8.49
26,108	William Rippon Bissill ...	Nottingham Flying Club	18.8.49
26,109	Peter Norman Morse	Qualified Service pilot...	19.8.49
26,110	Charles Alfred Mackaness ...	Sywell Aero Club ...	19.8.49
26,111	Horace Tinsley	United Services F.C. ...	19.8.49
26,112	Norman Donovan Roughsedge	Lancashire Aero Club ...	23.8.49
26,113	William James Twitchell ...	Luton Flying Club ...	24.8.49
26,114	Kenneth Charles Newbery ...	Fairoaks Aero Club ...	24.8.49
26,115	David Graham Bowker	Portsmouth Aero Club...	25.8.49
26,116	Peter Sumner Aked	Qualified Service pilot...	26.8.49
26,117	Maurice Robin Lipscombe ...	Southend Municipal School	29.8.49
26,118	Arthur John Linzee Hickox ...	South Coast Flying Club	29.8.49
26,119	William Sandeman Campbell...	Qualified Service pilot...	30.8.49
26,120	John Owen Edwards	Midland Aero Club ...	30.8.49
26,121	Maurice James Hibbert ...	Qualified Service pilot...	6.9.49
26,122	Peter Thomas Matthews ...	Qualified Service pilot...	6.9.49
26,123	John Maurice Wilson	South Coast Flying Club	2.9.49
26,124	Philip Victor Butler	Qualified Service pilot...	6.9.49
26,125	Kenneth Martin Reed	Qualified Service pilot...	6.9.49
26,126	Kenneth Ernest Richardson ...	Qualified Service pilot...	7.9.49
26,127	Eric Chatterley Hunt	Qualified Service pilot...	6.9.49
26,128	Leonard Charles Hazard ...	Herts and Essex A.C. ...	6.9.49
26,129	Jens Jessen-Pastor	Air Service Training ...	10.9.49
26,130	Kenneth Douglas Montrose ...	Lancashire Aero Club ...	20.9.49
26,131	Norman Hearn-Phillips ...	Redhill Flying Club ...	12.9.49
26,132	Robert Townley Briscoe ...	Hampshire Aero Club ...	13.9.49
26,133	Arnold Band	Qualified Service pilot...	13.9.49
26,134	Lulof Anton Vrind	Rearsby Flying School ...	16.9.49
26,135	Stanley Louis Cohen	Midland Aero Club ...	16.9.49
26,136	Eric Albert Bryon	7 F.T.S.	19.9.49
26,137	George Arthur Chesworth ...	7 F.T.S.	19.9.49
26,138	Jeremy Francis Bellville ...	Bembridge Aero Club...	19.9.49
26,139	Desmond Rogers	No. 7 F.T.S.	19.9.49
26,140	Khaja Yousufuddin	Air Service Training ...	19.9.49
26,141	Samuel Henry Davis	Midland Aero Club ...	19.9.49
26,142	Gerald Raymond Dingle ...	No. 6 F.T.S.	19.9.49
26,143	Charles Thomas Riley	No. 6 F.T.S.	19.9.49
26,144	Leslie James Hartley	Midland Aero Club ...	19.9.49
26,145	Anoushiravan Khoshkish ...	Southend Municipal School	20.9.49
26,146	Eric Francis Burgess	Qualified Service pilot...	20.9.49
26,147	Edward Henry Abbott Barnes...	Qualified Service pilot...	20.9.49

HIGH-SPEED NAVIGATION

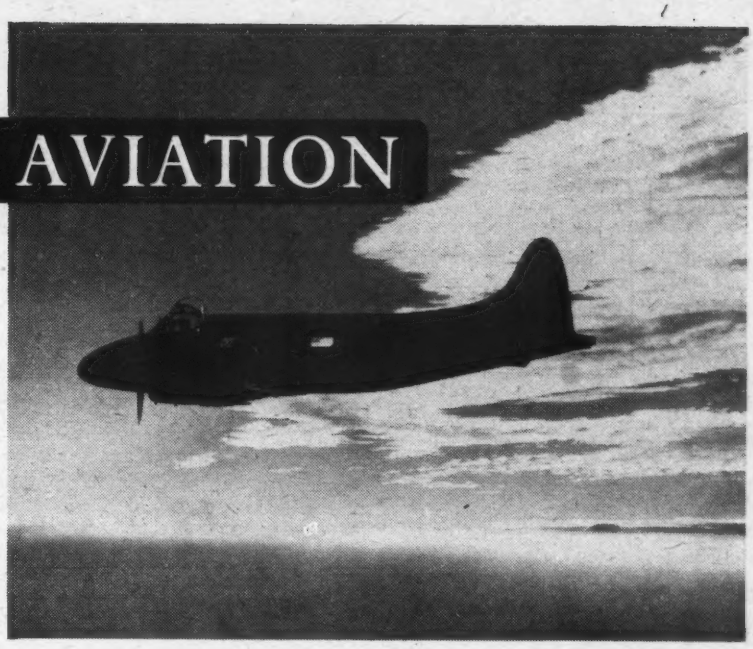
SOME of the navigational problems which, as the use of jet aircraft increases, will call for urgent solution, were discussed in a paper, *Navigation in High-Speed Flight*, read by W/C. E. W. Anderson before a meeting of the Institute of Navigation last Friday, November 18th.

By reason of the high fuel consumption of turbojets at low and medium altitudes, it is accepted that maximum speed consistent with fuel economy will be obtained at heights between 30,000ft and 40,000ft. In the light of this consideration, the speaker examined current conventional methods of navigation (such as dead reckoning based on the triangle of velocities and astro-navigation) and, pointing out that visual aids will be available less frequently, concluded that only radio—with a tendency towards high frequencies—will continue to provide reasonably accurate assistance to the navigator.

Detailed flight planning and continual fuel and time checks, utilizing time/distance and fuel/distance graphs, were considered by the lecturer to be essential parts of the new techniques which would be evolved. The prominent illustration of visual pinpoints on air maps and the use of astro-homing graphs computed for the route were among other methods which he mentioned as possible means of fulfilling the essential requirements of high-speed navigation; the aids should inform the airman of his next course of action rather than establish his present position.

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements



PROFILE : A typically British November fog is not, perhaps, the best setting for aerial photography. Nevertheless, this appealing silnouette of a D.H. Devon, secured under such conditions, pays tribute to the resourcefulness of *Flight's* photographer, with co-operation from pilots of the Empire Test Pilots' School. An illustrated survey of the work of the School will be featured in the next issue.

V.R. in Germany

WITHIN the next few weeks, says the Air Ministry, British subjects (both men and women) serving in a civilian capacity in the British Zone of Germany will be able to volunteer for the R.A.F.V.R. This will be the first occasion on which the V.R. has recruited members outside the British Isles since its formation in 1937.

There will be no flying branch in the R.A.F.V.R., Germany, and volunteers will be accepted for ground branches and trades only.

Support for R.A.F. Modellers

FOR several years there has been noticeable enthusiasm for aero-modelling among all ranks and branches of the R.A.F. There are 2,000 known modellers in the Service—and probably many more exist—and 150 active clubs. A welcome and logical step, therefore, is the formation of the R.A.F. Model Aircraft Association. Full details of the organization, entry conditions and future programmes of the Association will be made known after a meeting between its officers and members of the Society of Model Aeronautical Engineers.

Next year, it is hoped, will be held a competition embracing all commands, followed by an R.A.F. open contest. Representatives of all commands, and 90 Group, have been appointed to the committee of the Association. G/C. C. F. Pearce, of Technical Training Command, has been elected chairman; S/L. R. B. Lord, from Wittering, is secretary; and F/L. C. S. Cooke, D.F.C., A.F.C., A.F.M., of Transport Command H.Q., has been appointed treasurer.

An A.T.C. Film

THE first showing of a new gliding film, entitled *Wings for the A.T.C.*, was given recently in the officers' mess at Kenley. The film, which is in colour, has been produced by S/L. Driessen, District Gliding Officer, who gave a running commentary at its presentation. It is hoped that a sound-track will be incorporated in the film later.

Wings for the A.T.C., which runs for about 30 minutes, depicts a typical day at an A.T.C. Gliding School. Shots have been taken both from the air and from the ground, and all stages of training are shown. Following the showing, there was a general discussion on the film, and the verdict was unanimously favourable.

Among those present were Air Marshal R. M. Foster, the A.O.C.-in-C., Reserve Command; A. Cdre. T. N. McEvoy, the A.O.C., No. 61 (Eastern Reserve) Group; G/C. E. M. Donaldson, who is in charge of A.T.C. training and administration; and G/C. R. J. Gosnell and G/C. J. H. McC. Reynolds, the Senior Air Staff Officers of, respectively, No. 61 Group and No. 65 (London Reserve) Group.

Command-Change Celebration

AT their dining-in night on Wednesday of last week, No. 615 (County of Surrey) Squadron, R.Aux.A.F., entertained A.V-M. S. F. Vincent (A.O.C. No. 11 Group, Fighter Comman) and A. Cdre. T. N. McEvoy (A.O.C. No. 61 Group, Reserve Command). The occasion was in the nature of a small celebration to mark the transfer of the R.Aux. A.F. squadrons from Reserve to Fighter Command.

After F/L. Shillingford, the Auxiliary adjutant, had spoken kindly of the R.A.F., and F/L. Lang, the regular adjutant, had returned the Auxiliary compliment, S/L. Peter Devitt rose. He had, he said, the unpleasant task of saying good-bye to No. 61 Group and A. Cdre. McEvoy, who had been so helpful to the Squadron. The Air Commodore, he reminded his listeners, had flown his own aircraft out to Sylt to visit "615" at their summer camp this year and then, borrowing a Spitfire, had got the top score on the range. S/L. Devitt went on to say how proud he was to see the Squadron return to the Fighter Command fold.

A.V.M. Vincent, replying, welcomed the Auxiliaries to No. 11 Group—even though it entailed the Group's working a seven-day week. No. 615 had been under his command on two previous

HONOURS SHARED: Accompanying the men of the *Amethyst* in their march through the City of London were (left to right) G/C. J. N. Jefferson, Gnr. I I C. Devany, F/L. K. H. F. Letford and Sig. I G. E. Moreby, crew-members of the Sunderland which rendered valuable assistance in the Yangtse action

SERVICE AVIATION . . .

occasions, at Northolt during the Battle of Britain and later in Burma, where, in addition to their fine fighting record, they acquired a reputation for putting on—under any circumstances—a good tea with boiled eggs. A.V-M. Vincent then broke the news that he is leaving the R.A.F. in about six weeks, after 35 years in the service. He hoped he might be able to get into a local R.Aux.A.F. squadron as a flying officer! Referring to the jet aircraft which the Squadron is due to receive shortly, A.V-M. Vincent wished the unit the best of luck with its "man-sized" aircraft now that it was in a "man-sized" Group.

At a small party following dinner both of the A.O.C.s expressed willingness to make and sign their footprints on the ceiling—a tradition which was carried out with due ceremony.

V.R. Ground Training

GROUNDCREW members of the R.A.F.V.R. recently completed their first period of annual training since recruiting for this section of the Reserves began just over a year ago. Over 800 men and women were involved, and, where possible, Reserve Command arranged for each to spend the two-week period at the R.A.F. station of his or her choice.

Technical-Branch Occasion

A GUEST night to mark the inauguration of the Integrated Royal Air Force Technical College was held recently in the officers' mess at Henlow. Thirty senior officers were the guests of the Commandant (A. Cdre. D. W. R. Ryley, C.B.E.), the Assistant Commandants and the officers of the Technical College.

Among those present were Air Marshal Sir W. Alec Coryton, K.B.E., C.B., M.V.O., D.F.C., Controller of Supplies (Air), Air Marshal Sir John Whitworth Jones, K.C.B., C.B.E., A.O.C.-in-C., Technical Training Command, many senior officers of the Command, and senior technical officers of R.A.F. Home Commands.

BACK IN THE FIRST TEAM: No. 615 (County of Surrey) Squadron, R.Aux.A.F., celebrated its return to Fighter Command by entertaining its A.O.C., A.V-M. Vincent, No. 11 Group (left), and its former A.O.C., A.Cdre. McEvoy, No. 61 Group (right). In the centre is S/L. Devitt, the commanding officer of 615 Squadron. An account of the dinner is given in these pages.

In welcoming the formation of the College, Sir John Whitworth Jones traced the history of the Technical Branch, and said that an integrated college for the training of all technical officers with a headquarters and three divisions (at Henlow, Debden and Lindholme), had now been formed.

In replying, A. Cdre. Ryley thanked all those who had assisted in the formation of the College. He read a message from the Air Member for Technical Services, Air Marshal Sir R. Victor Goddard, who greatly regretted that he had been unable to attend, and who wished success to the part which would be played in the Royal Air Force by the Technical Branch.

Air Marshal Sir W. Alec Coryton referred to the extremely high standard of technical knowledge required from the staff of the Ministry of Supply, and expressed certainty that the College would prove that such knowledge would be attainable by all officers trained there.

HENLOW GUEST NIGHT: As reported above, the inauguration of the Royal Air Force Technical College was the subject of appropriate celebration. Among those present were the Commandant and Assistant Commandants: (left to right) G/C. R. F. Fletcher (Engineering, Henlow); A.Cdre. D. W. R. Ryley (Commandant); G/C. K. J. McKay (Armament, Lindholme); and G/C. N. D. Gilbart-Smith (Signals, Debden).

Malayan Record

DURING October, R.A.F. squadrons based at Kuala Lumpur have set up new record figures in operations supporting the security forces. No. 48 Squadron flew 106 sorties on supply dropping alone. Just under 400,000 lb of supplies were delivered during the month—seven times the average monthly figure since the emergency began. Drops were made to police and military parties on 206 separate dropping zones deep in the jungle areas of the Federation with almost 100 per cent accuracy, in spite of the difficulties of identification, terrain and weather. The squadron also dropped 263,000 Government surrender leaflets written in Chinese, Tamil and Malay on 45 areas in the various States, as well as transporting some 230 personnel and 31,000 lb of freight in aid of emergency operations.

No. 45 Squadron was equally busy in its own field of tactical support. Its Beaufighters flew over 100 sorties during the month. These strikes greatly assisted the jungle patrols by destroying camps and denying areas to the enemy, as well as by keeping insurgents continually on the move. Follow-up forces made arrests in the areas attached, and, coupled with the continuous harrying of insurgents by security forces, air strikes resulted in a number of surrenders in the operational areas.

This effort was made possible, reminds the Air Ministry, by the untiring efforts of the maintenance crews, the base supply packers and despatching crews, the armourers and the personnel of all ranks and trades who are behind each aircraft in the air.

Reunion

THE second reunion of officers appointed or attached to No. 4 Naval Fighter Wing during the war will be held at the Chatelain Restaurant, Gerrard Street, London, W.1, on January 7th, 1950, from 1830-2230 hr.